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ABSTRACT

This teacher's guide was developed for use in junior and senior high schools in Duval County, Jacksonville, Florida, for the purpose of identifying those secondary science laboratory experiences which are essential to the development of science content knowledge and competency in handling science laboratory equipment and consumables. The guide begins with a discussion of safety in the laboratory, and includes a copy of a student safety contract which is to be completed by each student and kept on file by the teacher. This section is followed by lists of laboratory equipment, county-adopted texts, and laboratory activity keys for all Anatomy and Physiology, Biology, Chemistry, Earth Science, Ecology, Life Science, Marine Biology, Marine Science, Physical Science, Physics, Science Survey, and Zoology courses. (CMG)

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ESSENTIAL LABORATORY ACTIVITIES GUIDE

SECONDARY SCIENCE

ED235285

DUVAL COUNTY PUBLIC SCHOOLS
HERB A. SANG, SUPERINTENDENT



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1982

ESSENTIAL LABORATORY ACTIVITIES GUIDE
SECONDARY SCIENCE

Prepared by

Clive Andriesse
Wolfson Senior High School

Joe Butler
Stanton College Preparatory School

David Carter
Northwestern Junior High School

Ollie Daniels, Ed.D.
Division of Instruction

Rory Dickens
Forrest Senior High School

William R. Fryar, Ed.D
Division of Instruction

Lois Gaston
Wolfson Senior High School

Mary Hackenberg
Raines Senior High School

Susan Hamner
Ribault Senior High School

Evelyn Hart
Ribault Junior High School

Judy Miller
Wolfson Senior High School

Dorothy Oliver
Jeff Davis Junior High School

Kathleen Poe
Kirby Smith Junior High School

Doris Pryor
Wolfson Senior High School

Claudia Storey
Stanton College Preparatory School

Richard Sweetsir
Kirby Smith Junior High School

Cover designed by

Linda Willcox

Edited by

Judith Silas

1982

INTRODUCTION

This teacher's guide was developed for the purpose of identifying those secondary science laboratory experiences which are essential to the development of 1) science content knowledge and 2) competency in handling science laboratory equipment and consumables. Safety, the first consideration, is discussed on pages S-1 through S-6. A safety contract is included on pages S-5 and S-6 which every student is to complete and teachers are to keep on file.

Since the necessary equipment and supplies must be available in sufficient quantity, teachers are encouraged to inventory these items in pre-planning so that missing materials can be ordered immediately. Each department head has the necessary ordering information as well as catalogs from the approved bid vendors.

Teachers are to document their laboratory instruction by 1) recording all Essential Laboratory (EL) grades in the gradebook and 2) filing the laboratory reports for each student by EL number. Laboratories other than EL's are recommended in the complete guide for each course which is available in the science office.

Activities are more than important for the secondary science student, they are essential. Questions regarding any of the activities included in this guide may be directed to the science office, 390-2129.

SAFETY IN THE SCIENCE LABORATORY*

Introduction

Safety should be first in the minds of administrators, teachers, and students actively involved in a science program. The responsibility for safety and the enforcement of safety regulations and laws is shared by everyone within the school community. With careful planning and instruction, a safe and healthful environment can be established within your science class.

You are encouraged to develop and maintain a safety program from the outset of the course. The information contained in this safety section will aid you in accomplishing this important task. The information is not intended to be all-inclusive, since no publication can list safe practices for science in every situation. The suggestions should not be read as legal requirements but rather as recommendations for the establishment of a safety base upon which to build.

Proper planning, prudent foresight, and care must be continuously exercised by everyone. By following the recommended safeguards and precautions contained in this section, you will be practicing good safety.

Safety Control Equipment

Instruments and tools play an important part in the safety program of any science course. You should not be afraid to do experiments or to use chemicals and equipment but should respect them as potential hazards. Before working in the laboratory, you should become familiar with the safety equipment applicable to your course, know its location, and know how to use each one. All equipment should be easily accessible to everyone and should be checked periodically to assure proper operation and cleanliness.

A list of general safety equipment follows. The course(s) you teach will dictate which equipment would be most beneficial.

Eye and Face Wash Fountains

Fountains prevent or reduce injuries from chemicals splashing in or near the eyes. The fountain is designed to provide a gentle flow of aerated water to cleanse the eye and surrounding areas of foreign substances for at least 15 minutes at a time. It should be checked daily for proper operation.

* Most of the information included here was taken, with permission, from Exercises and Experiments in Modern Chemistry, 1982, published by Holt, Rinehart, and Winston.

Safety Showers

Showers prevent or reduce injuries from caustic chemicals or acid burns, from contact with toxic chemical reagents, or from clothing fires. A good water supply is essential for a safety shower. The shower heads must be a nonclogging, deluge-type, capable of covering a contaminated area of skin with a flood of water that is sufficient to dilute material to a safe level in 15 seconds. It should be checked daily for proper operation.

Fire Blankets

Fire blankets are used to smother flaming hair or clothes. If the clothing is a polyester, the best way to put out the fire is to use the safety shower.

Fire Extinguishers

Extinguishers are used to put out fires. There are four recognized classes of fires; extinguishers are labeled to indicate which classes of fires they can be used to extinguish. Teachers and students should be familiar with the operating instructions for all fire extinguishers. Perhaps the local fire department would arrange a series of demonstration fires and give practice in extinguishment.

First Aid Kits

First aid kits are used to give emergency treatment for burns, cuts, and so on. Treatment should be administered only by the teacher. It is also recommended that a chart which shows proper treatment for specific injuries should be posted prominently near the kit.

Lab Aprons

Aprons are used to protect body and clothing from chemical hazards. The front side of the aprons should be coded so that you always know which side may have caustic chemicals on it. Remember to clean the aprons frequently.

Lab Gloves

Gloves protect hands from laboratory hazards. Everyone should have a pair to wear when handling chemicals, glass tubing, or heated materials.

Safety Goggles

Goggles protect eyes from chemical and particle injuries. Goggles should be worn over prescription glasses. The goggles should be washed/sterilized frequently and stored in a protected place. Contact lenses should not be worn in the lab.

Face Shields

Face shields protect head, face, and neck from chemical and particle injuries. One or two face shields should be available for the teacher to wear when working separately in the storage room with large quantities and highly reactive chemicals.

Sand Buckets

The sand is used to smother small fires such as one contained in a beaker. A scoop or hand shovel should be used to apply the sand.

Tongs

Tongs protect the hands from burns and chemical injuries. Always remember to use them when handling heated materials, especially in glass or porcelain containers.

Waste Containers

The waste containers prevent fires, explosions, and pollution. Separate waste containers or receptacles should be provided for each of the following: chemicals, matches, broken glass. NEVER use the wastepaper basket for disposal of materials.

Ventilation Hood

Ventilation hoods prevent the spreading of poisonous gases evolved in an experiment. Ventilation-hood-escape outlets and fans should be checked frequently to ensure proper operation.

Heat Resistant Mat

A heat resistant mat should be placed under hot apparatus that need to cool. This action will prevent the breakage of glass and porcelain containers that might otherwise shatter when they come in contact with the cool surface of the lab bench.

Spill Control Packages

These packages are designed to minimize the harmful effects of a chemical spill by absorbing the chemical and restricting its movement across the laboratory bench or floor. Some chemical manufacturers are producing spill control kits that can be ordered. Many spill control packages consist of a pail containing a mixture of sand and soda ash. Floor-drying compounds such as those used by garages are also cheap and effective for spill absorption.

Safety Evaluation Equipment

Many classrooms contain accessory equipment that is used to evaluate the safety conditions of the laboratory and classroom. This equipment helps to ensure that a safe and healthful environment is being maintained. Following is a list of equipment with a brief description of their purposes.

SAFETY EVALUATION EQUIPMENT

ITEMS	PURPOSE
Combustible Gas Meters	Take air measurements
Detector Tube Systems	Indicate presence of hazardous gases and vapors
Electric Hazard Testers	Evaluate static charge, current leaks, and electrical outlets
Geiger-Muller Counters	Measure radioactivity
Light Meters	Measure levels of illumination
Noise Meters	Measure sound levels
Radiation Detectors	Measure radiation
Velometers	Measure air flow
Ventilation Smoke Tubes	Measure air flow direction and rate
Wind Chimes or Mobiles	Indicate air flow

Laboratory Safety Contract

A sample student safety contract is included. You may copy it for use in your classroom or substitute one of your own choosing. Discuss the regulations with your students. Your lab manual may also contain safety information you might wish to discuss with your students.

STUDENT SAFETY CONTRACTSafety Regulations

To ensure that a safe and healthful environment is maintained when taking this laboratory course, you should read and follow the safety regulations listed below. To indicate that you have completely read and understand the safety regulations, you are asked to give your signature and the date upon completion of this important task in the spaces provided on the contract.

1. Safety goggles, apron, and gloves should be worn when the laboratory exercise necessitates this protection.
2. Contact lenses should not be worn in the laboratory because there is a distinct possibility that chemicals may infuse under the contact lenses and cause irreparable eye damage.
3. Prepare for each laboratory lesson by reading all instructions before you come to class. Follow all directions and review with your teacher the safety precautions needed to conduct the experiment safely before you begin. Only materials and equipment authorized by your teacher should be used. Do not perform unauthorized experiments.
4. Be alert and proceed with caution at all times in the laboratory. Take care not to bump another student, and remain in your lab station while performing an experiment. An unattended experiment can produce an accident.
5. Apparel should be appropriate for laboratory work. Long, hanging necklaces, bulky jewelry, and excessive and bulky clothing should not be worn in the laboratory. Cotton clothing is preferred over nylon, polyesters, or wool.
6. Only lab manuals and lab notebooks are permitted in the working areas. Other books, purses, and such items should be placed in your desk or storage area.
7. No food or beverage is permitted in any science laboratory.
8. NEVER taste chemicals. NEVER touch chemicals with your hands. Handle toxic, combustible, or radioactive substances only under the direction of your instructor. If you spill acid or another corrosive chemical, wash it off immediately with water. Never draw poisonous materials into a glass tube with your mouth. Keep combustible materials away from open flames.
9. Extreme caution should be exercised when using a burner. Keep your head and clothing away from the flame and turn off the burner when not in use. Gas burners should be lighted only with a sparker in accordance with your teacher's instructions.

10. Smother fires with a towel. If clothing should catch fire, smother it with a blanket or coat or quench it under a safety shower. NEVER RUN. Know the proper fire drill procedures and the location of fire exits.
11. Use the safety equipment provided for you. Know the location of the fire extinguisher, safety shower, fire blanket, and first aid kit.
12. Report any accident, injury, or incorrect procedure to your instructor at once.
13. Place broken glass and solid substances in designated containers. Keep insoluble waste material out of the sink.
14. NEVER WORK ALONE IN THE LABORATORY. Work in the laboratory while under the supervision of your teacher and with your assigned class.
15. When your investigation is completed, be sure to turn off the water and gas and disconnect electrical connections. Clean your work area. Return all materials and apparatus to their proper places.
16. Hands should be washed thoroughly with soap at the conclusion of each laboratory.

I, _____, have read and agree to abide by the safety regulations as set forth above and also any additional printed instructions provided by the teacher and/or school district. I further agree to follow all other written and verbal instructions given in class.

Signature

Date

TABLE OF CONTENTS

Materials lists and laboratory activity keys for secondary science courses are included in this guide in the following order:

<u>COURSE</u>	<u>LEVEL</u>	<u>PAGE ABBREVIATION</u>
Anatomy and Physiology	Senior High	A/P
Biology I	Senior High	B
Biology I, Advanced	Jr./Sr. High	B,A
Biology II, Advanced	Senior High	BII
Chemistry I	Senior High	CI
Chemistry I, Advanced	Senior High	CI,A
Chemistry II, Advanced	Senior High	CII
Earth/Physical Science, Advanced	Junior High	E/PS
Earth Science	Senior High	ES
Earth Science 9	Junior High	ES9
Ecology	Senior High	E
Life Science 7	Junior High	LS
Life Science 7, Advanced	Junior High	LS,A
Marine Biology I	Senior High	MBI
Marine Biology II, Advanced	Senior High	MBII
Marine Science	Senior High	MS
Physical Science 8	Junior High	PS8
Physical Science II	Senior High	PSII
Physics I and Physics I Advanced	Senior High	PI

<u>COURSE</u>	<u>LEVEL</u>	<u>PAGE ABBREVIATION</u>
Physics II B, Advanced	Senior High	PIIB
Science Survey, Biological	Senior High	SS-B
Science Survey, Earth/Space	Senior High	SS-E/S
Science Survey, Physical	Senior High	SS-P
Zoology	Senior High	Z

ESSENTIAL LABORATORY ACTIVITIES ANATOMY AND PHYSIOLOGY

State Accreditor Number . . 1371
Course Code Number. 2615

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Anatomy and Physiology. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the EL number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Drakontides, Anna B., et al, Anatomy and Physiology Workbook and Laboratory Manual (New York, N.Y.: MacMillan Publishing Co., Inc., 1977).

Equipment and Supplies

In addition to the usual equipment and supplies found in a biology laboratory, the following materials are necessary in order to perform labs designated as essential. Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed. Stock numbers are not given for dissection specimens and manuals. Individuals should select dissection specimens and appropriate lab manuals.

CATALOG NAME	ITEM NAME	STOCK NUMBER	CATALOG PAGE
Science Kit 82-83	epithelium	69172-05	310
	muscle	69178-05	310
	cartilage	69174-07	310
	tendon	69174-09	310
	nerve	69181-04	310
	bone	69174-03	310
	skeleton	67930-01	337
	dissection manual		551
Southern Biologi- cal 82-83	preserved mammal		17

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Anna B. Drakontides, et al, Anatomy and Physiology Workbook and Laboratory Manual (New York, N.Y.: Macmillan Publishing Co., Inc., 1977).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	2.5	Tissue Identification	15-26	T. G. Morrison, et al, <u>Experiments in Physiology</u> (New York: Holt, Rinehart and Winston, 1977), p. 14-16.	1
2	3.5	Bone Identification	39-58	Morrison, pp. 16-20.	1
3	3.6	Vertebrate Dissection/Muscle Identification	59-92	*E. S. Booth, et al, <u>Laboratory Anatomy of the Cat</u> (Dubuque, Iowa: William C. Brown Co., 1967), pp. 14-30. *D. Klingener, <u>Laboratory Anatomy of the Mink</u> (Dubuque, Iowa: William C. Brown Company, 1972), pp. 27-49. *T. Odlang, <u>Laboratory Anatomy of the Fetal Pig</u> (Dubuque, Iowa: William C. Brown Company, 1980), pp. 16-26.	1
* This is a suggested reference. Individual schools should order laboratory manuals appropriate for the mammal to be dissected.					

A/P-3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
4	4.4	Vertebrate Dissection/Brain and Spinal Cord Identification	93-116	Booth, pp. 50-55. Klingener, pp. 85-91. Odlang, pp. 72-81.	2
5	4.5	Reflex Action	102-03	Morrison, pp. 23-24.	2
6	5.6	Vertebrate Dissection/Cardiovascular Identification	147-53	Booth, pp. 38-46. Klingener, pp. 61-75. Odlang, pp. 52-67.	2
7	6.6	Vertebrate Dissection/Respiratory System Identification	167-69	Booth, pp. 38-46. Klingener, pp. 51-55. Odlang, pp. 68-71.	3
8	7.4	Vertebrate Dissection/Digestive System Identification	177-85	Booth, pp. 31-37. Klingener, pp. 55-59. Odlang, pp. 31-39.	3

A/P-4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
9	8.3	Vertebrate Dissection/ Urinary System Identification	195-98	Booth, p. 46. Klingener, p. 77. Odlang, p. 40.	4
10	9.5	Vertebrate Dissection/ Reproductive System Identification		Booth, pp. 47-50 Klingener, pp. 73-83. Odlang, pp. 41-51.	4

A/P-5

ESSENTIAL LABORATORY ACTIVITIES BIOLOGY I

State Accreditor Number . . 1314
Course Code Number. 2301

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Biology I. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested.

It is necessary for the teacher to provide documentation that each activity has been performed. Each EL activity is to be recorded in the grade book by the EL number. In addition, the teacher is to keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Kaskel, Albert, et al, Laboratory Biology Investigating Living Systems (Columbus, Ohio: Charles E. Merrill Publishing Co., 1979).

Equipment and Supplies

In addition to the usual equipment and supplies found in a biology laboratory, the following materials are necessary in order to perform labs contained in the county adopted laboratory manual. Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed.

CATALOG NAME	ITEM NAME	STOCK NUMBER	CATALOG PAGE
Flinn Scienti- fic Co. 1982	iodine solution	I0027	29
	methylene blue	M0072	36
	glucose (dextrose)	D0005	22
	sucrose	S0135	53
	starch	S0124	53
Science Kit 82-83	single-edged razor blades	62809W	322
	hot plates	62070	499
	elodea	67440	209
	lamp	62211-05	546
	tubing clamp	61135-01	482
Southern Biologi- cal 82-83	preserved frogs	P7302	15

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Albert Kaskel, et al, Laboratory Biology Investigating Living Systems
(Columbus, Ohio: Charles E. Merrill Publishing Co., 1979).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.1	Scientific Method	15-20	A. McCormack, et al, <u>Biology Laboratory Manual</u> (Glenview, Illinois: Scott, Foresman, 1980).	1
2	1.3	Microscope Skills	5-14	McCormack, pp. 11-16.	1
3	2.3	Organic Compound Identification	31-33, 41-44	McCormack, pp. 191-94.	1
4	3.3.5	Cell Observation	45-54	McCormack, pp. 21-24.	2
5	3.4	Particle Movement	55-56	McCormack, pp. 25-28.	2
6	4.2	Photosynthesis	85-88	McCormack, pp. 125-28.	2
7	5.6	Monohybrid Cross	113-16	McCormack, pp. 41-44.	3

B-3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
8	6.0	Frog Dissection		James Otto, et al, <u>Biology Investigations</u> (New York: Holt, Rinehart, and Winston, 1973), pp. 283-90	3
9	7.4	Classification Key	197-205	Otto, pp. 99-102.	4

B-4

ESSENTIAL LABORATORY ACTIVITIES BIOLOGY I, ADVANCED

State Accreditor Number . . 1314
Course Code Number. 2303

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Biology I, Advanced. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the EL number. In addition, the teacher is to keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

McCormack, A., et al, Biology Laboratory Manual (Glenview, Illinois: Scott, Foresman, 1980).

Equipment and Supplies

In addition to the usual equipment and supplies found in a biology laboratory, the following materials are necessary in order to perform labs contained in the county adopted laboratory manual. Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed.

CATALOG NAME	ITEM NAME	STOCK NUMBER	CATALOG PAGE
Science Kit 82-83	spot plates glucose test paper 1 ml pipettes pH paper dialysis tubing hot plates	68680 63212 62665-01 69642-03 61417-12 62070	505 357 503 154 27 499
Flinn Scientific Co. 1982	fructose (levulose) sucrose lactose starch sudan III powder iodine solution gelatin yeast biuret solution glucose (dextrose)	L0020 S0135 L0002 S0124 S0152 I0027 G0004 Y0002 B0051 D0005	31 53 30 53 53 29 26 57 13 22
Sargent-Welch 82-83	*amylase	26085	260
Southern Bio-logical Co. 82-83	preserved frogs	P7302	15
	*Amylase is not available from the bid vendor (Science Kit).		

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: A. McCormack, et al, Biology Laboratory Manual (Glenview, Illinois: Scott, Foresman, 1980).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.1	Scientific Method	7-10	Albert Kaskel, et al, <u>Laboratory Biology Investigating Living Systems</u> (Columbus, Ohio: Charles E. Merrill Publishing Co., 1979), pp. 15-20.	1
2	1.4	Microscope Skills	11-16	Kaskel, pp. 5-14.	1
3	2.3.4	Organic Compound Identification	191-94	Kaskel, pp. 31-33, 41-44.	1
4	2.5.1	Enzyme Characteristics	201-06	Kaskel, pp. 69-74.	1
5	3.4.5	Cell Examination	21-24	Kaskel, pp. 45-54.	2
6	3.6	Particle Movement	25-28	Kaskel, pp. 55-56.	2
7	4.3	Photosynthesis	125-28	Kaskel, pp. 85-88.	2

R, A-3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
8	5.6	Monohybrid Cross	41-44	Kaskel, pp. 113-16.	3
9	6.6	Frog Dissection		James Otto, et al, <u>Biology Investigations</u> (New York: Holt, Rinehart, and Winston, 1973), pp. 283-90.	4

B, A-4

ESSENTIAL LABORATORY ACTIVITIES
BIOLOGY II, ADVANCED

State Accreditor Number . . 1321
Course Code Number. 2310

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Biology II. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested.

It is necessary to provide documentation that each activity has been performed. Each EL activity is to be recorded in the gradebook by EL number. In addition, the teacher is to keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods is located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Kimble, John, Biology, A Laboratory Introduction (Reading, Massachusetts: Addison-Wesley, 1967).

Equipment and Supplies

In addition to the usual equipment and supplies found in a biology laboratory, the following materials are necessary in order to perform labs contained in the county adopted laboratory manual. Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed.

CATALOG NAME	ITEM NAME	STOCK NUMBER	CATALOG PAGE
Science Kit 82-83	5 ml pipette	62667-05	503
	30 ml beaker	60632-06G	466
	brush	68999	545
	Drosophila	67499-19	360
	incubator	62154	193
	phloroglucinol	85505-02	175
	hand microtome	66592	322
	oat seeds	67109	209
	10 ml pipettes	62667-10	503
	pipette filler	68671	503
	glass plates	61945-08D	515
Flinn 82	Benedict's solution	B0016	13
	soluble starch	S0123	53
	plain agar	A0013	8
	aceto carmine stain	CA116	17
	brewer's yeast	Y0002	57
	sucrose	S0134	53
	3-indoleacetic acid	I0002	28

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: John Kimble, Biology, A Laboratory Introduction (Reading, Massachusetts: Addison-Wesley, 1967).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.6.8	Enzyme Activity	27-31		1
2	2.2.12	Animal/Plant Cells	23-25		1
3	3.1.12	CO ₂ Production		Biology II, Advanced Resource Packet	2
4	4.15	Traits in Drosophila	111-17.		2
5	5.1.6	Plant Organs	53-56		3
6	6.4.6	Plant Growth	63-72		3
7	7.1.7	Effects of Exercise		Biology II, Advanced Resource Packet	3

ESSENTIAL LABORATORY ACTIVITIES CHEMISTRY I

State Accreditor Number . . 1316
Course Code Number. 2401

Introduction

The following twenty-two activities were designed to enhance the student's skills in the laboratory. For each activity the teacher is given a county adopted source and in most cases at least one or more supplementary sources. The supplementary sources may be ordered by the teacher at her/his expense.

A safety section is located at the beginning of this manual and should be used. Each student is required to sign a lab contract before starting the laboratory experiences.

As the instructor you are responsible for recording and grading each activity in your gradebook by essential laboratory number. It is also requested that you keep individual student files on each activity and keep it handy. Essential Laboratories #1-7 can be done together as an introductory experience. Essential Laboratories #16 and #18 are attached.

County Adopted Materials

Metcalfe, H. C., et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1982).

Metcalfe, H. C., et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1978).

Supplies and Equipment

See attached list.

EL #	EQUIPMENT	SUPPLIES
1	Bunsen burner	forceps, rubber tubing, matches or sparker, evaporating dish, copper wire
2		glass tubing, rubber stoppers, rubber tubing, soap, vaseline, glycerine
3	Triple beam balance, double pan balance, single pan balance	objects with weight
4		test tube, glazed paper, spatula, sodium chloride
5		graduated cylinder, ringstand, pipet, buret, buret clamp, 50 ml. beaker 250 ml. beaker, water
6	Bunsen burner	iron ring, ring stand, evaporating dish, funnel, filter paper, 250 ml. beaker, wash bottle, sparker or matches, sodium chloride, water, sand
7	Bunsen burner	calorimeter, graduated cylinder, thermometer (Celsius), ring stand, buret clamp, iron ring, beaker, tongs, sparker or matches, water
8	Triple beam balance, single pan balance, double pan balance	graduated cylinder, 100 ml. beaker, plastic metric ruler, thermometer (Celsius), metal shot (aluminum, copper, lead) water
9	Balance, bunsen burner	bar magnets, 250 ml. beaker, test tubes, funnel, graduated cylinder, magnifying lens, ring stand, watch glass, filter, paper, matches or sparker, iron filings, sulfur, hydrochloric acid, carbon disulfide
10	Balance, bunsen burner	evaporating dish, eye dropper, graduated cylinder, iron ring, ring stand, spatula, matches or sparker, sodium hydrogen carbonate, hydrochloric acid
11	Bunsen burner	cobalt glass plate, test tubes, forceps, platinum wires, matches or sparker, hydrochloric acid, nitrates of sodium, lithium, calcium, barium, potassium, strontium, distilled water

EL #	EQUIPMENT	SUPPLIES
12		Sargent molecular model set, or Johnglass student molecular kit
13	Balance	250 ml. beaker, crucible and cover, forceps, ring stand, iron ring, pipstem triangle, potassium chlorate, potassium chloride
14	Balance, bunsen burner, dessicator	iron ring, ring stand, tongs, crucible and cover, pipstem triangle, matches or sparker, barium chloride, anhydrous calcium chloride, potassium chloride, sodium aluminum sulfate, sodium chloride, clear crystals of magnesium chloride, potassium nitrate, sodium carbonate, sodium sulfate
15	Bunsen burner	filter paper, litmus paper, funnel, test tubes, evaporating dish, forceps, glass plate, graduated cylinder, eye dropper, iron ring, ringstand, matches or sparker, calcium trunings, copper foil, copper sulfate, mercury II oxide, sodium hydrogen carbonate, sulfur, zinc strip, ammonia water, hydrochloric acid, sodium hydroxide, aluminum chloride, chlorine water, lead nitrate, sodium bromide, sodium chloride, sodium iodine, sodium sulfite, silver nitrate, 100 ml. beaker
16		250 ml. beaker, #6 rubber stoppers, 600 ml. beaker, graduated cylinder, sink glass tubing, ringstand, buret clamp, sparker or matches, four objects of equal mass, carpet thread, Boyle's Law Apparatus
17		battery jar (1 quart) buret clamp, eudiometer, ring stand, thermometer (celsius) rubber stoppers, beakers, metric ruler, magnesium ribbon, thread, hydrochloric acid
18		styrofoam balls, pins, toothpicks, rubber bands

* Order early in the year.

EL #	EQUIPMENT	SUPPLIES
19	Balance, bunsen burner	beakers, wide mouth bottle, test tubes, evaporating dish, erlenmeyer flask, graduated cylinder, forceps, red and blue litmus, matches or sparker, calcium metal, calcium oxide, copper sulfate, phosphorus red, sodium aluminum sulfate, sodium hydrogen carbonate, sodium metal, lead II nitrate, potassium chromate
20	Balance, bunsen burner	erlenmeyer flask, mortar and pestle, #2 stoppers, thermometer (Celsius), graduated cylinder, matches or sparker, sodium thiosulfate pentahydrate, sodium hydroxide (pellets)
21		beaker, 12 test tubes, glass plate, graduated cylinder, pH paper, ammonia water, hydrochloric acid, sodium carbonate, sodium hydrogen carbonate, acetic acid, ammonium acetate, phosphoric acid, sodium chloride, sodium hydroxide
22		beakers, washbottle, 2 burets, double buret clamp, erlenmeyer flask, ring stand, hydrochloric acid, sodium hydroxide, phenolphthalein indicator

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: H. C. Metcalfe , et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart and Winston, 1982).

H. C. Metcalfe , et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart and Winston, 1978).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1		Using the Bunsen Burner	Metcalfe, 1978, 95-96. Metcalfe, 1982, 112-14.	T. E. Eckert , et al, <u>Problems in Chemistry</u> (Fairfield, New Jersey: Cebco, 1968), pp. 3-4. L. E. Carmichael, et al, <u>Laboratory Chemistry</u> (Columbus, Ohio: Merrill, 1979), p. 6.	1
2		Manipulating Glass (Demonstration Only)	Metcalfe, 1978, 96. Metcalfe, 1982, 114-15.	Eckert, et al, pp. 5-6. Carmichael, et al, pp. 10-11.	1
3		Using the Balance	Metcalfe, 1978, 96-97. Metcalfe, 1982, 116-18.	Carmichael, p. 8.	1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
4		Handling Solids	Metcalfe, 1978, 98. Metcalfe, 1982, 115-16.		1
5		Measuring Liquids	Metcalfe, 1978, 98. Metcalfe, 1982, 118-20.		1
6		Filtration Method	Metcalfe, 1978, 99. Metcalfe, 1982, 120-21.	Carmichael, p. 7.	1
7		Measuring Temperature	Metcalfe, 1978 100-01. Metcalfe, 1982, 122-24.		1
8	1.1.2	Accurately Measuring Mass, Volume, Density	Metcalfe, 1978, 103-04. Metcalfe, 1982, 129-34.	J. L. Thomas <u>Laboratory Experiments in Essential Chemistry</u> , (Encino, CA: Glencoe, 1979), pp. 5-10.	1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
9	1.4.1	Classifying Elements, Compounds, Mixtures	Metcalf, 1978, 117-20.	Carmichael, pp. 25-26.	1
10	2.5.2	Calculating Moles in a Chemical Reaction	Metcalf, 1982, 155-58.	Carmichael, pp. 47-48.	1
11	2.7.2	Identifying Metal Salts by the Color They Give to a Flame	Metcalf, 1978, 125-26. Metcalf, 1982, 143-46.	Carmichael, pp. 61-62. Eckert, pp. 345-46.	1
12	3.6.4	Constructing Molecular Models (Covalent Bonds)	Metcalf, 1978, 129-30.	Carmichael, pp. 83-84.	2
13	4.3.3	Determining Percent Composition of an Element in a Compound	Metcalf, 1978, 131-32.	Eckert, pp. 117-18. L. R. Summerlin, <u>Chemistry of Common Substances</u> (Morristown, New Jersey: Silver Burdett, 1979), pp. 43-44.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
14	4.7.1	Determining Empirical Formula of a Hydrate	Metcalfe, 1982, 151-54.	Carmichael, pp. 43-44. Thomas, pp. 47-51.	2
15		Identifying Types of Reactions	Metcalfe, 1978, 137-40.	Carmichael, pp. 29-31. Eckert, pp. 131-34.	2
16		Proving Boyle's Law	Metcalfe, 1978, 145-48. Metcalfe, 1982, 159-64.	Carmichael, pp. 111-12. Thomas, pp. 71-74.	3
	5.12.2	Verifying Charles' Law		Carmichael, pp. 115-17. See p. CI-10. Metcalfe, 1978. pp. 145-48. Eckert, p. 36.	
17		Determine Molar Volume	Metcalfe, 1982, pp. 171-74.	Thomas, pp. 87-92. Carmichael, pp. 125-27. Metcalfe, 1978. pp. 151-52.	3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
18	6.8.2	Constructing Crystal Structures		Carmichael, pp. 95-96. See p. CI-14. Eckert, pp. 23-24. Metcalf, 1966. pp. 171-73.	3
19		Identifying Physical and Chemical Properties of Water	Metcalf, 1978, 155-56.		3
20		Factors Affecting Solubility	Metcalf, 1982, 179-82.	Carmichael, pp. 139-40. Thomas, pp. 95-98.	4
21	8.15.5	Determining the Hydronium Ion Concentration	Metcalf, 1982, 193-96. Metcalf, 1978, 175-76.	Carmichael, pp. 169-71. Eckert, pp. 175-76.	4
22		Standardizing the Titration of an Acid/Base	Metcalf, 1982, 197-200.	Carmichael, pp. 179-81. Summerlin, pp. 95-96.	4

Gas Laws: The Effect of Temperature on Volume

The volume of a gas increases as temperature increases if the pressure remains constant. According to the kinetic theory, an increase in temperature will cause the molecules of a gas to move faster and exert more pressure and the gas will expand. Conversely, as a gas is cooled, the molecules will move more slowly and the gas will contract or exert less pressure. This relationship between the volume of a gas and its temperature is known as **Charles' Law**.

Objective

In this experiment we study the effects of temperature on a gas and develop a new constant V/T . The symbol V will be used for volume and T for temperature. To simplify the mathematics, the temperature will be expressed in kelvin ($K = \text{Celsius temperature} + 273$).

Equipment

250 mL Erlenmeyer flask
No. 6 one-hole rubber stopper
600 mL beaker
graduated cylinder (50 or 100 mL)
ice

large pneumatic trough or deep sink
glass tubing for stopper (or 3 cm dropper pipet)
laboratory burner
ringstand, support ring, wire gauze
buret clamp

Procedure

1. Set up the apparatus as shown in Figure 1. Obtain a 600 mL beaker and add approximately 250 mL of tap water. Obtain a 250 mL Erlenmeyer flask. Place a one-hole stopper fitted with a 3 cm glass tube or a dropper pipet in the flask and place the flask in the beaker of water as shown in the figure. Heat the water to boiling. Record this temperature as T_1 in the data table on page 116. Heat to the desired temperature and continue heating at this temperature for 3 to 5 minutes by lowering the flame of laboratory burner.
2. Prepare a pneumatic trough or stopper the sink and add water. Adjust the water to the specific temperature (T_2) assigned to you. (See Figure 2.)
3. Remove the flask from the beaker. Place your finger firmly over the end of the glass tubing (protect your hand with a towel) and submerge the flask in the trough or sink. (Do not allow air to enter the flask while transferring.)
4. Remove your finger from the glass tubing and hold the flask under (with open end down) until its temperature is near that of the water. When the flask has cooled and the water ceases to enter, raise the flask, (glass tube down) until the water level inside is equal to the water level outside (See Figure 2). Pressure inside is now equal to the barometric reading; that is, room pressure.
5. Place your finger over the glass tubing while the outside and inside levels are equal. Remove the flask and place it in an

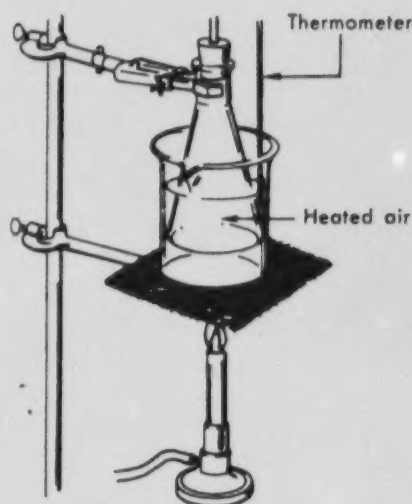


FIGURE 1. Apparatus set-up for Step 1.

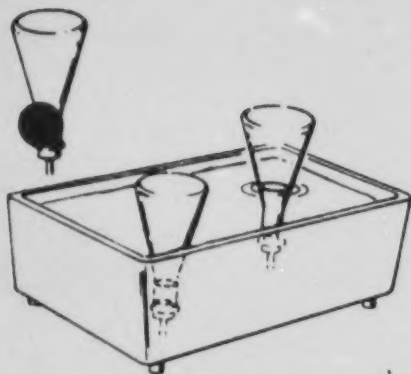


FIGURE -2. Apparatus set-up for Step 2.

upright position on your lab table before removing your finger. Make a mark at the bottom of the rubber stopper and remove it. Measure the volume of the water in the flask with a graduated cylinder. Record the volume of water in the flask as Item 3 in the data table.

6. Refill the flask with tap water to where you placed the mark at the bottom of the rubber stopper. Measure this volume of water in a graduated cylinder and record it as the total volume of the flask. Also record the temperature of the water bath and of the water in the pneumatic trough or sink.
7. Repeat the procedure as Trial 2 using two different temperatures, T_1 - T_2 . Trial 2 may be plotted on the same graph with Trial 1, but will not fall on the same line.

Data Observations

	Trial 1	Trial 2	Trial 3
1. Initial temperature of air (hot) T_1	°C K	°C K	°C K
2. Final temperature of air T_2	°C K	°C K	°C K
3. Volume of water in flask after experiment	cm ³	cm ³	cm ³
4. Total volume of flask (to bottom of stopper = volume of gas in the flask)	cm ³	cm ³	cm ³
5. Final volume of the gas (4 - 3)	cm ³	cm ³	cm ³
6. Atmospheric pressure (barometer reading)*	m bars	m bars	m bars
7. Vapor pressure of water at T_2 (See Table , p. CI-13.)	m bars	m bars	m bars
8. Pressure of dry gas (6-7)	m bars	m bars	m bar
9. Volume of dry gas at atmospheric pressure	cm ³	cm ³	cm ³

* 1 millibar = .750 mm

Make a graph. Plot temperature in kelvin on the horizontal axis and volume in cm^3 on the vertical axis for each trial. Extrapolate to locate the temperature at which the volume would be zero for each trial. Group data may be plotted in Trial 1, of T_1 (boiling point of H_2O was the same for each student.)

Questions

1. Look at your graph of temperature vs volume. What relationship exists between the variables? (Is it a direct, inverse, linear, or power relationship?) What is the general equation for this relationship?
2. From the graph, choose two convenient temperature points (T_1 and T_2). Find the volumes that correspond to T_1 and T_2 from the graph (V_1 and V_2). If V varies directly with T , then $V = kT$. Solving for k , we find $k = V/T$. Using the points selected, calculate the k values for each point and compare. You may wish to compare your k values with other students who used the same T_1 .
3. What does the point at which your curve crosses the horizontal axis represent?
4. What could be a source of error in the experiment?
5. If the volume of a gas is 300 cm^3 at 27°C , what volume will it occupy at 20°C ?

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VAPOR PRESSURE OF WATER

TEMPERATURE (°C)	PRESSURE (mbar)	PRESSURE (mmHg)	TEMPERATURE (°C)	PRESSURE (mbar)	PRESSURE (mmHg)
-5	4.00	3.00	25.5	32.6	24.5
0	6.10	4.58	26	33.6	25.2
5	8.72	6.54	26.5	34.7	26.0
8	10.7	8.03	27	35.6	26.7
10	12.3	9.22	27.5	36.7	27.5
12	14.0	10.5	28	37.8	28.4
14	16.0	12.0	28.5	38.9	29.2
16	18.2	13.7	29	40.1	30.1
18	20.6	15.5	29.5	41.3	31.0
20	23.4	17.6	30	42.4	31.8
20.5	24.1	18.1	35	56.2	42.4
21	24.9	18.7	40	73.8	55.4
21.5	25.6	19.2	50	123	92.3
22	26.4	19.8	60	199	149
22.5	27.1	20.4	70	312	234
23	28.1	21.1	80	473	354
23.5	28.9	21.7	90	701	525
24	29.8	22.4	100	1013	760
24.5	30.8	23.1	200	15544	11660
25	31.7	23.8			

Ion or Atom Arrangement in Crystals

The modern definition of the crystal is - a **crystal** is a rigid body in which the constituent particles are arranged in a repeating pattern. The simplest unit of repetition in this arrangement is called the **unit cell**. At the present, there are fourteen different three-dimensional unit cells which make up crystalline solids. They are

Unit Cell Structure

Different arrangements

cubic

simple, body-centered, face-centered

tetragonal

simple, body-centered

orthorhombic

simple, single face-centered, body-centered, face-centered

monoclinic

simple, single face-centered

triclinic

simple

trigonal

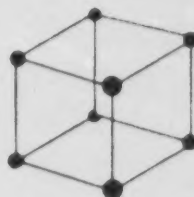
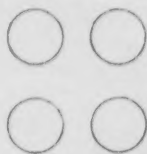
simple

hexagonal

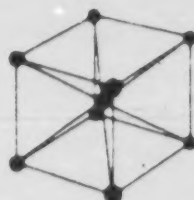
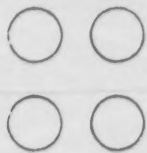
simple



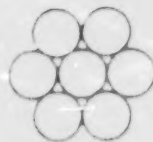
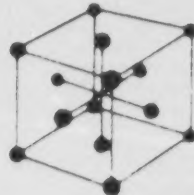
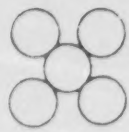
simple cubic



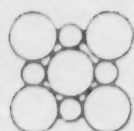
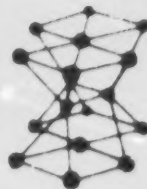
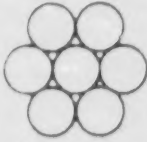
Body-centered cubic



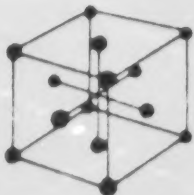
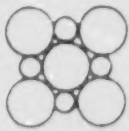
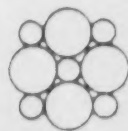
Face-centered cubic



Hexagonal closest packing



Ionic crystal (NaCl)



Some possible
metallic and ionic crystal unit
cell arrangements

Objective

CI - 15

In this experiment, you will build models of some of these unit cells in order to gain some insight into the three-dimensional arrangement of particles in crystals.

Equipment

Various sizes of styrofoam balls (Suggested diameters: 1/2 inch, 3/4 inch, 1 inch, and 2 inch.)
pins, toothpicks, or rubber bands

Procedure

Using styrofoam spheres and toothpicks, construct the following unit cells using the figure as a guide.

1. Cubic Structures
 - (a) Simple cubic
 - (b) Body-centered cubic
 - (c) Face-centered cubic
2. Complex cubic
 - (a) Ionic Crystal - NaCl
3. Closest Packing
 - (a) Hexagonal

Before you disassemble your models, write answers for the questions below using your models and textbook.

Questions

1. By examining the three unit cells, simple cubic, face-centered cubic (FCC), and body-centered cubic (BCC), predict the number of particles which occupy a unit cell by adding up all of its shared parts. (Hint: If you put eight simple cubic cells together in such a way that they touch at one vertex, you should be able to see that 1/8 of the shared particle would be in each of the eight cells).
2. A sodium ion, in crystalline NaCl, would be surrounded by how many chloride ions?

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ESSENTIAL LABORATORY ACTIVITIES CHEMISTRY I, ADVANCED

State Accreditor Number . . . 1316
Course Code Number. 2402

Introduction

The following twenty-four activities were designed to enhance the student's skills in the laboratory. For each activity the teacher is given a county adopted source and in most cases at least one or more supplementary sources.

As the instructor, you are responsible for recording and grading each activity in your gradebook by Essential Laboratory (EL) number. It is also suggested that you keep individual student files on each activity and keep it handy. Essential laboratories #1-7 can be done together as an introductory experiment. Essential Laboratory #16 is attached.

A safety section is located at the beginning of this manual and should be used. Each student is required to sign a laboratory safety contract before starting the laboratory experiences.

Following this introduction you will find a list of essential equipment and supplies which can be ordered using Science Kit 1982-83 (equipment) and 1982 Chemical, Flinn (chemicals). An early order of equipment and supplies may ensure adequate delivery time.

County Adopted Materials

Metcalf, H. C., et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1982).

Metcalf, H. C., et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1978).

Equipment and Supplies

See attached list.

EL #	EQUIPMENT	SUPPLIES
1	Bunsen burner	evaporating dish, rubber tubing, forceps, matches/sparker, copper wire
2		glass tubing, rubber stoppers, rubber tubing, soap, vaseline, glycerin
3	Single pan balance, triple beam balance	weighing paper, spatula, sodium chloride
4		test tubes, glazing paper, spatula, sodium chloride
5		graduated cylinder, pipet, buret, ringstand, buret clamp, 50 ml and 250 ml beakers, water
6	Bunsen burner	ring stand, iron ring, evaporating dish, funnel, filter paper, 250 ml beakers, washing bottle, matches/sparkers, sodium chloride, sand, water
7	Bunsen burner	calorimeter, graduated cylinder, thermometer (Celsius), ringstand, iron ring, buret clamps, beaker tongs, 250 ml beaker, matches/sparker, water
8	Balance	100 ml beaker, graduated cylinder, metric ruler, thermometer (Celsius) metal shot (aluminum, copper, lead)
9	Bunsen burner	100 ml and 150 ml beaker, forceps, iron ring, ring stand, test tubes, thermometer (Celsius), wash bottle, watch glass, wooden splints, matches/sparker, alka-seltzer, baking powder, copper foil, magnesium ribbon, platinum wire, zinc, filter paper, hydrochloric acid, sulfuric acid, silver nitrate
10	Balance, Bunsen burner	evaporating dish, eye dropper, graduated cylinder, iron ring, ring stand, spatula, matches/sparker, sodium hydrogen carbonate, hydrochloric acid
11	Bunsen burner	cobalt glass plates, test tubes, forceps, platinum wire, matches/sparker, hydrochloric acid, distilled water, sodium chloride, nitrates of: barium, calcium, lithium, potassium, sodium, strontium

EL #	EQUIPMENT	SUPPLIES
12		Sargent molecular model set
13	Balance	250 ml beaker, crucible and cover, forceps, iron ring, ring stand, pipestem triangle, potassium chlorate, potassium chloride
14	Balance, Bunsen burner, dessicator	ring stand, iron ring, tongs, spatula, crucible and cover, pipestem triangle, matches/sparker, barium chloride, calcium chloride, crystals of: potassium chloride, sodium aluminum sulfate, sodium chloride
15	Bunsen burner	beakers, buret clamp, test tubes, evaporating dish, forceps, funnel, glass plate, graduated cylinder, medicine dropper, iron ring, ring stand, filter paper, litmus paper, matches/sparker, calcium turnings, copper foil, copper sulfate, crystals of mercury oxide, sodium hydrogen carbonate, sulfur powder, zinc strip, ammonia water, hydrochloric acid, sodium hydroxide, aluminum chloride, chlorine water, copper sulfate, lead nitrate, sodium bromide, sodium chloride, sodium iodide, sodium sulfite, silver nitrate
16	Bunsen burner	Four objects with mass, carpet thread, Boyle's law apparatus*, mercury (Metcalf, 1978), erlenmeyer flask, #6 stopper, 600 ml beaker, graduated cylinder, glass tubing, iron ring, ring stand, buret clamp, matches/sparker
17		battery jar, buret clamp, eudiometer, ringstand, thermometer (Celsius), rubber stopper #00, beakers, metric ruler, thread, magnesium ribbon untarnished, hydrochloric acid

* Order early in the year.

EL #	EQUIPMENT	SUPPLIES
18	Balance	erlenmeyer flask, test tubes, 250 ml beakers, graduated cylinder, sodium acetate, ammonium thiocyanate, potassium chloride, ferric nitrate, sodium phosphate, methyl red, hydrochloric acid, acetic acid, potassium chromate, sodium hydroxide, KSCN, potassium dichromate, iron III chloride
19	Balance, Bunsen burner	beakers, wide mouth bottle, test tubes, evaporating dish, erlenmeyer flask, forceps, graduated cylinder, litmus paper, matches/sparker, calcium metal, calcium oxide, copper sulfate, phosphorus red, sodium aluminum sulfate, sodium hydrogen carbonate, sodium metal, lead II nitrate, potassium chromate
20	Balance, Bunsen burner	600 ml and 800 ml beakers, iron ring, ring stand, buret clamp, test tubes, thermometer (Celsius), matches/sparker, acetamide
21	Balance, Bunsen burner	erlenmeyer flask, mortar and pestle, #2 stopper, thermometer (Celsius), test tubes, graduated cylinder, matches/sparker, sodium thiosulfate pentahydrate, sodium hydroxide pellets
22	Balance, Bunsen burner	test tubes, beaker, test tube clamps, iron ring, ring stand, thermometer (Celsius), matches/sparker, acetamide, fine sugar
23		250 ml beakers, test tubes, glass plates, graduated cylinder, pH paper (wide and narrow), ammonia water, hydrochloric acid, sodium carbonate, sodium hydrogen carbonate, acetic acid, ammonium acetate, phosphoric acid, sodium chloride, sodium hydroxide
24		beakers, wash bottle, two burets, double buret clamp, erlenmeyer flask, ring stand, hydrochloric acid, sodium hydroxide, phenolphthalein

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: H. C. Metcalfe, et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1978).

H. C. Metcalfe, et al, Exercises and Experiments in Modern Chemistry (New York: Holt, Rinehart, and Winston, 1982).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.0	Using Bunsen Burner	Metcalfe, 1978, 95-96. Metcalfe, 1982, 112-14.	T. E. Eckert, et al, <u>Discovery Problems in Chemistry</u> (Fairfield, N.J.: Cebco, 1968), pp. 3-4.	1
2	1.0	Manipulating Glass (Demonstration only)	Metcalfe, 1978, 96. Metcalfe, 1982, 114-15.	Eckert, pp. 5-6. L. E. Carmichael, et al, <u>Laboratory Chemistry</u> (Columbus, Ohio: Merrill 1979), pp. 10-11.	1
3	1.0	Using the Balance	Metcalfe, 1978, 96-97. Metcalfe, 1982, 116-18.	Carmichael, p. 8.	1
4	1.0	Handling Solids	Metcalfe, 1978, 98. Metcalfe 1982, 104-05, 115-16.		1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
5	1.0	Measuring Liquids	Metcalfe, 1978, 98. Metcalfe, 1982, 105-06, 118-20.		1
6	1.0	Filtration Method	Metcalfe, 1978, 99. Metcalfe, 1982, 120-21.	Carmichael, p. 7.	1
7	1.0	Measuring Temperature	Metcalfe, 1978 100-01. Metcalfe, 1982, 122-24.		1
8	1.1.2	Accurately Measuring	Metcalfe, 1978, 103-04. Metcalfe, 1982, 129-34.	J. L. Thomas, <u>Laboratory Experiments in Essential Chemistry</u> (Encino CA: Glencoe, 1979), pp. 5-10.	1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
9	1.4.8	Identifying Physical and Chemical Changes of Matter	Metcalfe, 1978, 119-20.	Carmichael, pp. 25-26. Eckert, pp. 15-16. L. E. Summerlin, <u>Chemistry of Common Substances</u> (Morristown, N.J.: Silver Burdett, 1979), pp. 4-6.	1
10	2.4.4	Calculating Moles in a Chemical Reaction	Metcalfe, 1982, 155-58.	Carmichael, pp. 47-48.	1
11	2.6.1	Identifying Metal Salts	Metcalfe, 1978, 125-26. Metcalfe, 1982, 143-46.	Carmichael, pp. 61-62. Eckert, pp. 345-46.	1
12	2.9	Constructing Molecular Models (Covalent Bonds)	Metcalfe, 1978, 129-30.	Carmichael, pp. 83-84.	2
13	4.3.3	Determining the Percent Composition of an Element in a Compound	Metcalfe, 1978, 131-32.	Eckert, pp. 117-18.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
14	4.3.4	Determining Empirical Formula of a Hydrate	Metcalfe, 1982, 151-54.	Carmichael, pp. 43-44. Thomas, pp. 47-51.	2
15	4.6.2	Identifying Types of Reactions	Metcalfe, 1978, 137-40.	Carmichael, pp. 29-31. Eckert, pp. 131-34. Summerlin, pp. 39-41.	2
16	5.8	Proving Boyle's Law or Verifying Charles' Law	Metcalfe, 1982, 159-64. Metcalfe, 1978, 145-48.	Carmichael, pp. 111-12. Thomas, pp. 71-74. Carmichael, pp. 115-17. Metcalfe, 1978, pp. 145-48. Eckert, p. 36. See p. CI,A-11.	3
17	5.11	Determining Molar Volume	Metcalfe, 1982, 171-74.	Thomas, pp. 87-92 Carmichael, pp. 125-27. Metcalfe, 1978, pp. 151-52.	3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
18	6.3	Determining Equilibrium; LeChatelier's Principle	Metcalfe, 1978, 211-13. Metcalfe, 1982, 227-30.	Eckert, pp. 157-58. Carmichael, pp. 153-55.	3
19	6.11.1	Identifying Physical and Chemical Properties of Water	Metcalfe, 1978, 155-56.		3
20	1.5	Determining Energy and Entropy: Phase Change	Metcalfe, 1982, 135-40. Metcalfe, 1978, 123-24.	Carmichael, pp. 135-36.	1
21	7.0	Factors Affecting Solubility	Metcalfe, 1982, 179-82.	Carmichael, pp. 139-40. Thomas, pp. 95-98. Summerlin, pp. 70-71.	4
22	7.8.3	Determining Freezing Point Depression of a Solvent	Metcalfe, 1982, 183-88.	Carmichael, p. 144. Summerlin, pp. 72-73. Thomas, pp. 103-11.	4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
23	8.1.4	Determining the Hydronium Ion Concentration	Metcalfe, 1982, 193-96. Metcalfe, 1978, 175-76.	Carmichael, pp. 169-171. Eckert, pp. 175-176.	4
24	8.10.1	Standardizing the Titration of an Acid/Base	Metcalfe, 1982, 197-200. Metcalfe, 1978, 182-85.	Carmichael, pp. 179-81. Summerlin, pp. 95-96.	4

CI, A-10

Gas Laws: The Effect of Temperature on Volume

The volume of a gas increases as temperature increases if the pressure remains constant. According to the kinetic theory, an increase in temperature will cause the molecules of a gas to move faster and exert more pressure and the gas will expand. Conversely, as a gas is cooled, the molecules will move more slowly and the gas will contract or exert less pressure. This relationship between the volume of a gas and its temperature is known as **Charles' Law**.

Objective

In this experiment we study the effects of temperature on a gas and develop a new constant V/T . The symbol V will be used for volume and T for temperature. To simplify the mathematics, the temperature will be expressed in kelvin ($K = \text{Celsius} + 273$).

Equipment

250 mL Erlenmeyer flask
No. 6 one-hole rubber stopper
600 mL beaker
graduated cylinder (50 or 100 mL)
ice

large pneumatic trough or deep sink
glass tubing for stopper (or 3 cm dropper pipet)
laboratory burner
ringstand, support ring, wire gauze
buret clamp

Procedure

1. Set up the apparatus as shown in Figure 1. Obtain a 600 mL beaker and add approximately 250 mL of tap water. Obtain a 250 mL Erlenmeyer flask. Place a one-hole stopper fitted with a 3 cm glass tube or a dropper pipet in the flask and place the flask in the beaker of water as shown in the figure. Heat the water to boiling. Record this temperature as T_1 in the data table on page 116. Heat to the desired temperature and continue heating at this temperature for 3 to 5 minutes by lowering the flame of laboratory burner.
2. Prepare a pneumatic trough or stopper the sink and add water. Adjust the water to the specific temperature (T_2) assigned to you. (See Figure 2.)
3. Remove the flask from the beaker. Place your finger firmly over the end of the glass tubing (protect your hand with a towel) and submerge the flask in the trough or sink. (Do not allow air to enter the flask while transferring.)
4. Remove your finger from the glass tubing and hold the flask under (with open end down) until its temperature is near that of the water. When the flask has cooled and the water ceases to enter, raise the flask, (glass tube down) until the water level inside is equal to the water level outside (See Figure 2). Pressure inside is now equal to the barometric reading; that is, room pressure.
5. Place your finger over the glass tubing while the outside and inside levels are equal. Remove the flask and place it in an

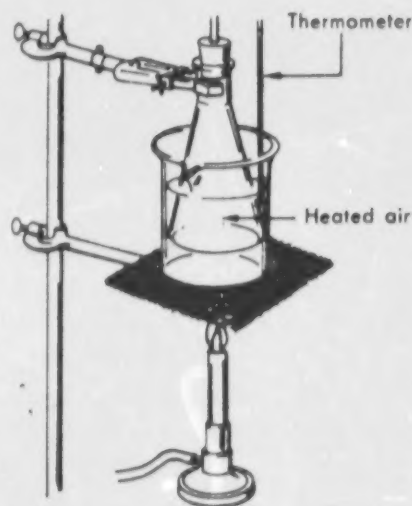


FIGURE 1. Apparatus set-up for Step 1.

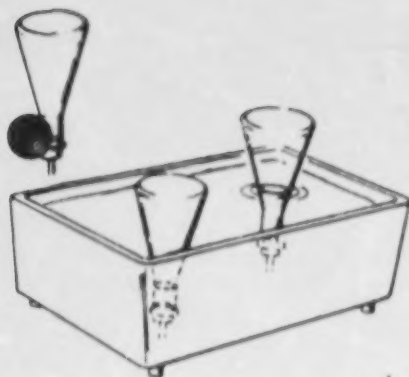


FIGURE 2. Apparatus set-up for Step 2.

upright position on your lab table before removing your finger. Make a mark at the bottom of the rubber stopper and remove it. Measure the volume of the water in the flask with a graduated cylinder. Record the volume of water in the flask as Item 3 in the data table.

6. Refill the flask with tap water to where you placed the mark at the bottom of the rubber stopper. Measure this volume of water in a graduated cylinder and record it as the total volume of the flask. Also record the temperature of the water bath and of the water in the pneumatic trough or sink.
7. Repeat the procedure as Trial 2 using two different temperatures, T_1 - T_2 . Trial 2 may be plotted on the same graph with Trial 1, but will not fall on the same line.

Data Observations

	Trial 1	Trial 2	Trial 3
1. Initial temperature of air (hot) T_1	$^{\circ}\text{C}$ K	$^{\circ}\text{C}$ K	$^{\circ}\text{C}$ K
2. Final temperature of air T_2	$^{\circ}\text{C}$ K	$^{\circ}\text{C}$ K	$^{\circ}\text{C}$ K
3. Volume of water in flask after experiment	cm^3	cm^3	cm^3
4. Total volume of flask (to bottom of stopper = volume of gas in the flask)	cm^3	cm^3	cm^3
5. Final volume of the gas (4 - 3)	cm^3	cm^3	cm^3
6. Atmospheric pressure (barometer reading)*	m bars	m bars	m bars
7. Vapor pressure of water at T_2 (See Table, p. CI,A-14.)	m bars	m bars	m bars
8. Pressure of dry gas (6-7)	m bars	m bars	m bar
9. Volume of dry gas at atmospheric pressure	cm^3	cm^3	cm^3

* 1 millibar = 750 mm

Make a graph. Plot temperature in kelvin on the horizontal axis and volume in cm^3 on the vertical axis for each trial. Extrapolate to locate the temperature at which the volume would be zero for each trial. Group data may be plotted in Trial 1, of T_b (boiling point of H_2O was the same for each student.)

Questions

1. Look at your graph of temperature vs volume. What relationship exists between the variables? (Is it a direct, inverse, linear, or power relationship?) What is the general equation for this relationship?
2. From the graph, choose two convenient temperature points (T_1 and T_2). Find the volumes that correspond to T_1 and T_2 from the graph (V_1 and V_2). If V varies directly with T , then $V = kT$. Solving for k , we find $k = V/T$. Using the points selected, calculate the k values for each point and compare. You may wish to compare your k values with other students who used the same T_b .
3. What does the point at which your curve crosses the horizontal axis represent?
4. What could be a source of error in the experiment?
5. If the volume of a gas is 300 cm^3 at 27°C , what volume will it occupy at 20°C ?

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VAPOR PRESSURE OF WATER

TEMPERATURE (°C)	PRESSURE (mbar)	PRESSURE (mmHg)	TEMPERATURE (°C)	PRESSURE (mbar)	PRESSURE (mmHg)
-5	4.00	3.00	25.5	32.6	24.5
0	6.10	4.58	26	33.6	25.2
5	8.72	6.54	26.5	34.7	26.0
8	10.7	8.03	27	35.6	26.7
10	12.3	9.22	27.5	36.7	27.5
12	14.0	10.5	28	37.8	28.4
14	16.0	12.0	28.5	38.9	29.2
16	18.2	13.7	29	40.1	30.1
18	20.6	15.5	29.5	41.3	31.0
20	23.4	17.6	30	42.4	31.8
20.5	24.1	18.1	35	56.2	42.4
21	24.9	18.7	40	73.8	55.4
21.5	25.6	19.2	50	123	92.3
22	26.4	19.8	60	199	149
22.5	27.1	20.4	70	312	234
23	28.1	21.1	80	473	354
23.5	28.9	21.7	90	701	525
24	29.8	22.4	100	1013	760
24.5	30.8	23.1	200	15544	11660
25	31.7	23.8			

ESSENTIAL LABORATORY ACTIVITIES
CHEMISTRY II, ADVANCED

State Accreditor Number . . 1325
Course Code Number. 2410

Introduction

Chemistry II, Advanced, will be field tested 1983-1984 school year.

Activities used in this course should help students understand topics and not be a science-fair type activity. The listed activities are minimum and relate to those suggested in the AP guidelines. Teachers are encouraged to supplement with more activities as appropriate.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory setting. Proper safety procedures should be introduced, stressed, and maintained. All students must sign a laboratory safety contract.

County Adopted Materials

Slowinski, Emil J., et al, Chemical Principles in The Laboratory (Philadelphia: Saunders College Publishing, 1981).

Equipment and Supplies

Refer to the laboratory manuals for the equipment list and supplies.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: E. J. Slowinski, et al, Chemical Principles in the Laboratory (Philadelphia: Saunders College Publishing, 1981).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	2.1.6	Empirical Formula Determination		H. C. Metcalfe, et al, <u>Exercises and Experiments in Modern Chemistry</u> (New York, N.Y.: Holt, Rinehart and Winston, 1982), pp. 151-54.	1
2	2.2.5	Mass and Mole Determination		Metcalfe, <u>Exercises and Experiments in Modern Chemistry</u> (New York, N.Y.: Holt, Rinehart and Winston, 1982), pp. 155-58.	1
3	6.4.3	Molecular Weight Determination	173-82		2
4	9.3.3	Qualitative Analysis	289-311	R. U. Prumblay, <u>Qualitative Analysis</u> (New York, N.Y.: Barnes and Noble Books, 1964).	3, 4

ESSENTIAL LABORATORY ACTIVITIES EARTH/PHYSICAL SCIENCE

State Accreditor Number . . 1354

Course Code Number. 2261

Introduction

Because all IPS laboratory experiences are essential to the accomplishment of objectives 1.0-5.0, they have not been included here. Rather, laboratory activities have been listed which are important for attainment of the earth science objectives, 6.0-8.0. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. Other resources or laboratories may be substituted for or added to those suggested.

It is necessary for the teacher to provide documentation that each activity has been performed. Whereas each essential activity for objectives 6.0, 7.0, and 8.0 is to be recorded in the gradebook by the EL number, it is necessary to document only one laboratory for each of the major IPS objectives (1.0-5.0). In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instructions in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Namowitz, Samuel N., Earth Science Activities, (Lexington, Mass.: D. C. Heath and Company, 1981).

Equipment and Supplies

Materials needed for the performance of each exercise are indicated at the beginning of that exercise. In addition, a summary of principal items is provided on pages VII-IX of the lab book. Review supply needs well ahead of time, and place orders sufficiently early to ensure receiving materials before they are needed.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Material: Namowitz, Samuel N., Earth Science Activities, (Lexington, Mass.: D. C. Heath and Company, 1981).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	6.1.6	Crystal Formation	1-2		4
2	6.1.7	Mineral Identification	3-10		4
3	6.2.3	Sedimentary Rock Identification	13-14		4
4	7.2.4	Absorption and Radiation of Energy: Land and Water	91-93		4
5	7.2.5	Absorption and Radiation of Energy: Color Factor	95-97		4
6	7.4.3	Evaporation	107-08		4
7	7.4.6	Dew Point	109-10		4

E/PS-2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
8	8.1.3	Porosity and Permeability	25-26		4
9	8.1.7	Hard and Salt Water	27-28		4
10	8.2.4	Sea Water and Fresh Water	47-48		4

ESSENTIAL LABORATORY ACTIVITIES

EARTH SCIENCE

State Accreditor Number . . 1343

Course Code Number 2230

Introduction

The following laboratory activities are the minimum required for Earth Science. Other experiences and activities will enhance the program. The teacher should supplement with activities from the text, Activities book or his/her own experience.

It will be necessary for the teacher to provide documentation that each activity has been performed. It is suggested that each essential activity be recorded in the grade book by the EL (Essential Laboratory) number. In addition, the teacher is to keep on file the student activity sheets for each Essential Laboratory performed.

Safety is a requirement in the laboratory and instruction in proper laboratory safety procedures and methods should be presented. Refer to the front of this manual for additional safety information. Students will sign a laboratory safety contract.

County Adopted Material

W. L. Ramsey, et al, Modern Earth Science (New York: Holt, Rinehart, and Winston, Publishers, 1979).

W. L. Ramsey, et al, Activities and Investigations: Modern Earth Science (New York: Holt, Rinehart, and Winston, Publishers, 1979).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered in sufficient time to insure their arrival in time to perform the laboratory activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Harvard Trip Balance	Science Kit 82-83	66323	459
(Single Beam-1 per group of 4)			
Hook Weight Sets	Science Kit 82-83	60465	452
(1 set per group of 4)			
Mineral Sets (1 per group of 4)	Science Kit 82-83	63994	412
Igneous Rocks (1 set per group of 4)	Science Kit 82-83	63997	411
Sedimentary Rocks	Science Kit 82-83	63999	411
(1 set per group of 4)			
Metamorphic Rocks	Science Kit 82-83	63998	411
(1 set per group of 4)			

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: W. L. Ramsey, et al, Modern Earth Science (New York: Holt, Rinehart, and Winston, Publishers, 1979).

W. L. Ramsey, et al, Activities and Investigations: Modern Earth Science (New York: Holt, Rinehart, and Winston, Publishers, 1979).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.1.3	Determining Density		W. L. Ramsey, et al, <u>Holt Earth Science</u> (New York: Holt, Rinehart, and Winston, Publishers, 1978). pp. 10-12. W. L. Ramsey, et al, <u>Holt Earth Science</u> (New York: Holt, Rinehart, and Winston, Publishers, 1982). p. 56. Irving L. Horowitz, <u>Earth Science Investigations</u> (New York: AMSCO School Publications, Inc., 1973) pp. 5-7.	1
2		Moon Phases		Ramsey, 1978. pp. 386. Horowitz, p. 141.	1 or 2
3	3.1.3	Mineral Identification	Text, 535-48. <u>Activities</u> , 85.	Ramsey, 1978. pp. 146-47. Horowitz, pp. 53-68.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
4	3.1.5	Rock Identification	<u>Activities</u> , 81.	Ramsey, 1978. pp. 170-72.	2
5		Earthquake Locations	Text, 222.	Ramsey, 1978. pp. 25. Horowitz, p. 31	2 or 3
6		Volcano Locations	Text, 200.	Ramsey, 1978. p. 31	2 or 3
7		Epicenter Locations	<u>Activities</u> , 105.	Horowitz, p. 255.	3
8	3.5.5	Physical and Chemical Weathering		Ramsey, 1978. pp. 177, 182. Horowitz, p. 239.	2
9	4.5.2	Density Currents	Text, 358.	Ramsey, 1978. pp. 344-45.	3
10	5.2.2	Heat Transferral	Text, 43.	Ramsey, 1978. pp. 358-59.	4
11	5.3.3	Dew Point	Text 442-43.	Ramsey, 1978. pp. 280-81. Horowitz, p. 189.	4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
12	5.3.2	Psychrometer	<u>Activities</u> , 211.	Ramsey, 1978. pp. 267-68, 271-73.	4

ESSENTIAL LABORATORY ACTIVITIES

EARTH SCIENCE 9

State Accreditor Number . . . 1343

Course Code Number. 2235

Introduction

The following laboratory activities are required for Earth Science 9. Additional laboratory experiences and activities will enhance the program and are strongly recommended. Some have been suggested for the teacher, and information has been provided in the resource packet for earth science. Others should be drawn from the teacher's own experience.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

A listing of necessary equipment and supplies accompanies each essential laboratory activity; all materials should be readily available in each school.

County Adopted Materials

Coble, C. R., et al, Earth Science: Laboratory/Activity Book (Englewood Cliffs, New Jersey: Prentice-Hall, 1981).

Ramsey, W. L., et al, Holt Earth Science Resource Book (New York: Holt, Rinehart and Winston, 1982).

Schachter, M., et al, Laboratory Program for Concepts and Challenges in Earth Science (Fairfield, New Jersey: Cebco Standard Publishing, 1979).

Earth Science Resource Packet.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: W. L. Ramsey, et al, Holt Earth Science (New York: Holt, Rinehart and Winston, 1982).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.2.4	Identification		W. L. Ramsey, et al, <u>Holt Earth Science Resource Book</u> (New York, New York: Holt, Rinehart and Winston, 1982), p. 87.	1
2	1.4.3	Soil Analysis		M. Schachter, et al, <u>Laboratory Program for Concepts and Challenges in Earth Science</u> (Fairfield, New Jersey: Cebco Standard Publishing, 1979), pp. 23-24.	1
3	2.1.4	Convection Currents		C. R. Cobel, et al, <u>Earth Science: Laboratory/Activity Book</u> (Englewood Cliffs, New Jersey: Prentice-Hall, 1981), pp. 89-90.	2
4	2.2.4	Locations	30-31		2
5	3.2.3	Chemical Weathering	187		2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
6	4.1.8	Oxygen Percentage		Coble, pp. 59-60.	2
7	4.2.7	Evaporation Cooling	283		3

ES9-3

ESSENTIAL LABORATORY ACTIVITIES

ECOLOGY

State Accreditor Number . . 1365

Course Code Number. 2625

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Ecology. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested. A packet of resource materials for field work and classroom activities is available from the science office, 390-2129.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the EL number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods is located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Greisel, Irma, and Jensch, Peter, Investigating Our Ecosystem (Boston, Mass.: Houghton Mifflin Company, 1976).

Equipment and Supplies

In addition to the usual equipment and supplies found in a high school science laboratory, the following materials are necessary in order to perform labs designated as essential. Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed.

CATALOG NAME	ITEM NAME	STOCK NUMBER	CATALOG PAGE
Science Kit 82-83	secchi disc soil sieve kit soil sampling tubes psychrometers soil analysis outfit water quality analysis safranin O	65912 66030-01 66345 66053-15v 68981 66701 87178-03	371 419 419 427 418 366 177
Flinn Scienti- fic Co. 1982	ammonium molybdate ammonium oxalate crystal violet solution eosin gram's iodine solution manganous sulfate Nessler's reagent sodium thiosulfate solution stannous chloride	AOA54 Axo58 Cx132 E0023 G00A9 M0030 N0024 S0150 S0120	10 10 21 23 27 34 37 52 52
Science Kit 82-83	fermentation tube	61633-10	513

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Irma Greisel and Peter Jensch, Investigating Our Ecosystem (Boston, Mass.: Houghton Mifflin Company, 1976).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.5	Field study	21-35	<u>Ecology Resource Packet</u> , (Duval County Public Schools, 1980).	1-4
2	4.2	Water analysis	42-59	<u>Ecology Resource Packet</u> .	1
3	4.5	Soil analysis	65-74	<u>Ecology Resource Packet</u> .	2
4	4.8	Air analysis	88-93	<u>Ecology Resource Packet</u> .	2
5	5.2.4	Population Growth Measurement		Paul J. Hummer, Jr., et al, <u>Probing Levels of Life: A Laboratory Manual</u> (Columbus, Ohio: Charles E. Merrill Publishing Co., 1979). pp. 191-97.	3
6	5.3.7	Distribution Determination		<u>Ecology Resource Packet</u> .	3
7	6.6	Seasonal Rhythms		<u>Ecology Resource Packet</u> .	1-4

E-3

EL NUMBEREQUIPMENT AND SUPPLIES

- | | |
|------|--|
| 2, 3 | student microscope (1)
slide and cover slip (1)
medicine dropper (1)
specimen for viewing |
| 4 | student microscope (1)
slides and cover slips (2)
medicine dropper (1)
iodine stain

onion
toothpick (1)
dissecting needle (1) |
| 5 | student microscope (1)
slide and cover slip (1)
cotton thread (several small pieces)
pond water (cultured to maximize
protozoan populations) |
| 6 | flowers (3-4)
magnifier (1)
scalpel (1)
student microscope (1)
slide and cover slip (1)
medicine dropper (1) |
| 7 | large beakers (2)
funnels (2)
small test tubes (2)
elodea (3 springs)
light source
metric ruler (1)
masking tape
scissors
water |
| 8 | preserved earthworm (1)
dissecting kit and pan (1)
pins (10-20)
magnifier (1) |
| 9 | glass aquarium or gallon jar (1)
soil, sand, plants, animals, etc. |
| 10 | large jars of equal volume (7)
day-old tap water
pond water containing algae
masking tape
detergent (powder) |

ESSENTIAL LABORATORY ACTIVITIES GUIDE
SECONDARY SCIENCE

Prepared by

Clive Andriesse
Wolfson Senior High School

Joe Butler
Stanton College Preparatory School

David Carter
Northwestern Junior High School

Ollie Daniels, Ed.D.
Division of Instruction

Rory Dickens
Forrest Senior High School

William R. Fryar, Ed.D
Division of Instruction

Lois Gaston
Wolfson Senior High School

Mary Hackenberg
Raines Senior High School

Susan Hamner
Ribault Senior High School

Evelyn Hart
Ribault Junior High School

Judy Miller
Wolfson Senior High School

Dorothy Oliver
Jeff Davis Junior High School

Kathleen Poe
Kirby Smith Junior High School

Doris Pryor
Wolfson Senior High School

Claudia Storey
Stanton College Preparatory School

Richard Sweetsir
Kirby Smith Junior High School

Cover designed by

Linda Willcox

Edited by

Judith Silas

1982

ESSENTIAL LABORATORY ACTIVITIES

LIFE SCIENCE 7

State Accreditor Number . . 1323
Course Code Number. 2220

Introduction

The following laboratory activities are the minimum required for Life Science 7. Remember to document completion of these activities by 1) recording each activity by an Essential Lab (EL) number in your grade book, and 2) by maintaining a file of written student reports for each activity. There are other experiences and activities which will enhance the students' science program and the teacher should supplement the EL activities with other activities from the text, lab/activity book, and his/her own experience.

The teacher should begin the course with instruction in proper laboratory procedures and methods, with emphasis on laboratory safety (refer to safety section in the front of this book). Of particular importance in this course are the safe handling of alcohol burners, the necessity of wearing safety goggles, and the importance of washing hands with soap following each laboratory period. Students should sign a laboratory safety contract.

County Adopted Materials

Webster, Vera, et al, Life Science (Englewood Cliffs, N.J.: Prentice-Hall, 1980).

Coble, C. R., and Rice, D. R., Life Science Laboratory/Activity Book (Englewood Cliffs, N.J.: Prentice-Hall, 1980).

Equipment and Supplies

Below is a list of the equipment and supplies needed for each EL activity. Unless otherwise stated, the number of each item needed is given for each group of two students. Be sure to review the laboratory activities and supply needs well ahead of time. Place supply orders early!

EL NUMBER

EQUIPMENT AND SUPPLIES

1

student microscope (1)
slide and cover slip (1)
specimen for viewing (1-2)

2

alcohol burner and stand (1)
Celsius thermometer (1)
250 ml beaker (1)
water
ice
safety goggles (2 pair)
graph paper

- 3 student microscope (1)
slides and cover slips (2)
medicine dropper (1)
iodine stain
onion
toothpick (1)
dissecting needle (1)
- 4 flowers (3-4)
magnifier (1) or hand lens (1)
scalpel (1)
student microscope (1)
slide and cover slip (1)
medicine dropper (1)
- 5 preserved earthworm (1)
dissecting kit and pan (1)
pins (10-20)
magnifier (1)
- 6 glass aquarium or gallon jar (1)
sand, soil, plants, animals, etc.
- 7 large jars of equal volume (7)
day-old tap water
pond water containing algae
masking tape
detergent (powder)
lawn fertilizer (powder)
plant tissues (apple cores, fruit skins, etc.)
pan balance (1 for every 3 or 4 groups
will be sufficient)
filter paper or paper toweling
teaspoons (3)

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Vera Webster, et al, Life Science (Englewood Cliffs, N.J.: Prentice-Hall, 1980)

C. R. Coble and D. R. Rice, Life Science Laboratory/Activity Book (Englewood Cliffs, N.J.: Prentice-Hall, 1980)

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	2.3	Using the Microscope	Webster, 494-95. Coble, 9-14.	P. F. Brandwein, et al, <u>Life: Its Forms and Changes</u> (New York: Harcourt Brace Jovanovich, Inc., 1972), pp. 533-36.	1
2	3.4	Constructing Graphs		Essential Laboratory Number 2, "Time vs. Temperature," LS-5 .	1
3	4.1.4	Comparing Plant and Animal Cells	Webster, 213.		1
4	5.4.8	Anatomy of a Flower	Webster, 373.	Brandwein, p. 292.	1
5	5.5.4	Earthworm Dissection		Brandwein, pp. 344-46. Essential Laboratory Number 5, "Earthworm Dissection," pp. LS - 6-10.	1
6	6.2.2	Food Webs in an Aquarium/Terrarium	Webster, 341-44. Coble, 39-42.	Brandwein, p. 12.	2

LS-3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	6.7	Effects of Pollutants on Algae	Webster, 464.		2

LS-4

ESSENTIAL LABORATORY NUMBER 2

Time Versus Temperature

Purpose: To use data tables and graphs to record data.

Materials:

1. Burner stand
2. Water
3. Thermometer
4. Beaker (250 ml)
5. Alcohol burner
6. Graph paper
7. Ice (1 bag)

Procedure:

1. Fill the beaker about $\frac{1}{4}$ full with water.
2. Place beaker on burner stand.
3. Insert thermometer into water; record temperature. (This is temperature at 0 minutes).
4. Light the burner and take the temperature reading at 30 second intervals for a period of five minutes. Record readings on chart.
5. Insert three ice cubes, again take the temperature readings at 30 sec. intervals for a period of five minutes. Record.
6. Plot all data on a graph.
7. Answer the following questions.

Questions :

1. What is the temperature after five minutes of heating?
2. At what time does the temperature start to drop?
3. What is the difference between the lowest and highest reading?
4. Between what times does the temperature drop the most?

[illegible]

ESSENTIAL LABORATORY NUMBER 5

Earthworm Dissection

Purpose: To identify the internal structures of the earthworm which enable it to carry on necessary life functions.

Materials: Preserved earthworm, dissecting pan, scalpel, probe, dissecting pins, forceps, magnifier.

Procedures:

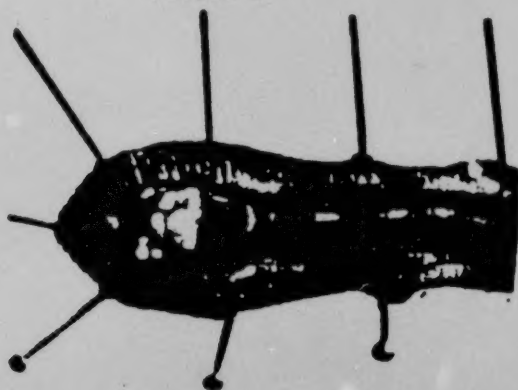
Stretch your worm out in a dissecting pan containing wax, or on a corkboard, a piece of pine, or other soft wood. Be certain the top surface of the earthworm is up before you pin the first segment of the head end down firmly. Next, place another pin through the tail end so that it, too, is firmly fixed.

With a scalpel, cut carefully through the body wall, starting at the tail end. (Do not cut too deeply or you will cut into the internal organs.) After you have made a cut about an inch long, try to force the skin open with the points of pins or dissecting needles. You will find that there are internal partitions at most segments. Cut these away from the body wall. Now you can pin back the body wall as shown in the photograph (see figure 1.)

Continue cutting, pinning the body wall back every five segments, until you reach the head end. Now all the internal organs should be exposed. Observe that the right and left sides are mirror images of each other. Biologists say that the earthworm has bilateral symmetry.

Using the photograph and drawings as a guide, see how many of the various organs you can locate in your worm. Counting the segments from the head end will help you locate the different organs.

FIGURE 1



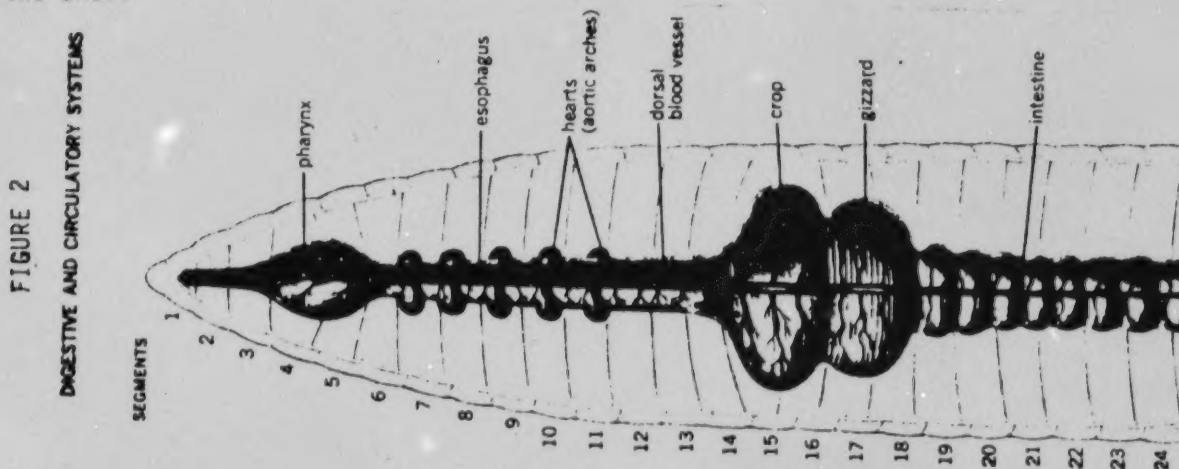
Digestive System (figure 2)

This system is a long tube that runs from the mouth to the anus. The mouth opens into the pharynx (segment three). This area contains glands that secrete fluids to lubricate the food. The pharynx is muscular, so that the food is mixed with the fluids. Food then goes through the esophagus into the thin-walled crop. The crop stores the food temporarily and releases it slowly to the thick, muscular gizzard.

An earthworm has no teeth or jaws. The food is chewed in the gizzard. Grains of sand in the gizzard tear food particles apart as the muscular walls of the gizzard work the food back and forth. (Do you know another kind of animal that grinds its food in a gizzard?)

From the thick, muscular gizzard, the food now ground up passes into the long intestine. Digestive enzymes are secreted from glands that line the intestinal tube. These digest fats, proteins, and carbohydrates.

Digested foods are absorbed into the blood stream from the intestine, and the remaining indigestible materials are excreted through the anus.



Circulatory System (figure 2)

The circulatory system consists of five pairs of hearts (segments seven through eleven) and blood vessels that run lengthwise in the body. The hearts are really just muscular tubes that connect the large dorsal blood vessel with a similar large ventral blood vessel.

The hearts force blood from the large dorsal blood vessel to the large ventral blood vessel. The blood moves through the ventral blood vessel and goes out through many branching vessels to the digestive organs and other body parts. After going through thin-walled capillaries, the blood moves into larger vessels and finally enters the large dorsal blood vessel where it moves forward to the hearts again.

Excretory System (figure 3)

Every segment of the body except the first three and the last few has a pair of kidney-like organs that excrete the nitrogenous wastes. All liquid wastes are excreted by these coiled-tube kidneys through the excretory pores.

Reproductive System (figure 3)

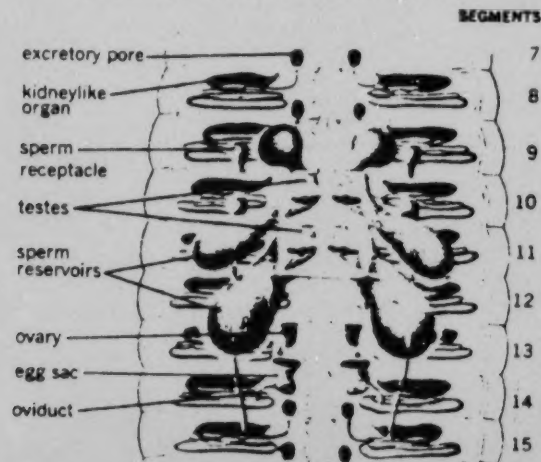
Each earthworm is both male and female. That is, each earthworm produces both sperm and eggs. In reproduction, two earthworms exchange sperm. They never fertilize themselves.

The male reproductive system includes two pairs of tiny testes (segments ten and eleven). These can be found in the lower part of the segments. They are difficult to find, so you may wish to use a hand lens to locate them. Much easier to see are the large sperm reservoirs in which the sperm develop further and are stored in a fluid until needed. The three pairs of sperm reservoirs extend up and around the esophagus in segments nine to twelve.

The female reproductive system consists of tiny ovaries on the underneath surface in segment thirteen. Eggs develop in the ovaries and then pass to the egg sacs. From here they leave the body through tiny tubes opening through the body wall (segment fourteen). You will need a hand lens to locate the ovaries.

You may have noticed the band around the outside of an earthworm. It has a Latin name, clitellum. The clitellum secretes a kind of slime that forms a sheath that picks up both the eggs and the sperm as it slips forward over the body of the worm. This sheath then changes into a kind of cocoon that is deposited in the moist earth where the eggs hatch out into tiny worms.

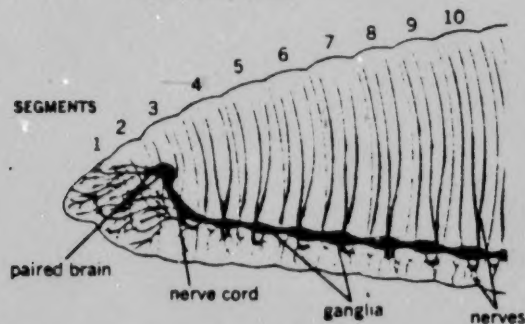
FIGURE 3
REPRODUCTIVE AND EXCRETORY SYSTEMS



Nervous System
(figure 4)

Above the pharynx (in segment three) is a tiny paired brain. Two nerve cords run from here down to the bottom, where they connect, becoming a nerve cord. This nerve cord runs along the lower part of the worm and on to the last segment. In each segment you will find the nerve cord swelled into a collection of nerve cells, called ganglia. (The brains are really just large ganglia.) Nerves branch off from these ganglia and the nerve cord to all parts of the body. Some of these nerves end in structures that are sensitive to light. These light-sensitive structures are most numerous at the head and tail ends.

FIGURE 4
NERVOUS SYSTEM



Figures 1, 2, 3, and 4 are from Life: Its Forms and Changes, Second Edition by Paul F. Brandwein, et al. Copyright ©1972, 1968 by Harcourt Brace Jovanovich, Inc. Reprinted by permission of the publisher.

QUESTIONS

1. Name three organs in the earthworm's digestive system which you were able to locate and give the function of each:

<u>ORGAN</u>	<u>LOCATION</u>	<u>FUNCTION</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

2. Name an organ which lies under (hidden by) the sperm reservoirs and give its function:

<u>ORGAN</u>	<u>FUNCTION</u>
_____	_____
_____	_____

3. Why were you unable to locate any organs of the respiratory system?

4. Sketch your earthworm and label the organs you were able to locate.

ESSENTIAL LABORATORY ACTIVITIES
LIFE SCIENCE 7, ADVANCED

State Accreditor Number . . . 1323
Course Code Number. 2222

Introduction

The following laboratory activities are the minimum required for Life Science 7, Advanced. Remember to document the completion of each activity by 1) recording each activity by Essential Laboratory (EL) number in your grade book, and 2) maintaining a file of students' written reports of each activity. There are many other experiences and activities which will enhance the students' science program, and the teacher should supplement the essential laboratory activities with other activities from the text, lab/activity book, and his/her own experience.

All laboratory activities except number 8 (earthworm dissection) can be found in the county-adopted text or its companion lab/activity book. The earthworm dissection activity is located in this manual on pages LS- 6-10. It may be duplicated and given to the students.

The teacher should begin the course with instruction in proper laboratory procedures and methods, with emphasis on laboratory safety. Please refer to the safety section at the front of this manual. It is particularly important that the students wash their hands thoroughly with soap after each laboratory period. Students should sign a laboratory safety contract.

County Adopted Materials

Webster, Vera, et al, Life Science (Englewood Cliffs, N.J.: Prentice-Hall, 1980).

Coble, C. R., and Rice, D. R., Life Science Laboratory/Activity Book (Englewood Cliffs, N.J.: Prentice-Hall, 1980).

Equipment and Supplies

Below is a list of the equipment and supplies needed for each essential laboratory activity. Unless otherwise stated, the number of each item needed is given for each group of two students. Be sure to review the laboratory activities and supplies well ahead of time. Place supply orders early!

EL NUMBER

EQUIPMENT AND SUPPLIES

1

bean seeds (16)
5 cm. flower pots (3)
potting soil
graduated cylinder (1)
metric ruler (1)
labels (3) or masking tape

EL NUMBEREQUIPMENT AND SUPPLIES

10 (continued)

lawn fertilizer (powder)
plant tissue (apple cores, fruit skins,
etc.)
pan balance (1 for every 3 to 4 groups
will be sufficient)
filter paper or paper toweling
teaspoons (3)

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Vera Webster, et al, Life Science (Englewood Cliffs, N.J.: Prentice-Hall, 1980).
C. R. Coble and D. R. Rice, Life Science Laboratory/Activity Book (Englewood Cliffs, New Jersey: Prentice-Hall, 1980).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.2	Scientific Method	Coble, 53-56.		1
2	1.3.5	Microscope Use	Webster, 494-95. Coble, 9-14.	P. F. Brandwein, et al, <u>Life: Its Forms and Changes</u> (New York: Harcourt Brace Jovanovich, 1972), pp. 533-36.	1
3	1.3.4	Wet Mount Preparation	Webster, 494-95. Coble, 9-14.	Brandwein, pp. 533-36.	1
4	2.4	Plant and Animal Cell Comparison	Webster, 213.		1
5	2.7.4	Single-Celled Organisms in Pond Water	Webster, 137.	Jahn and Jahn, <u>How to Know The Protozoa</u> (Dubuque, Iowa: Wm. C. Brown Co., 1949). Brandwein, pp. 311, 313.	1
6	3.5.5	Flower Anatomy	Webster, 373.	Brandwein, p. 292.	1

LS,A - 4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	3.8	Oxygen Production in Plants	Webster, 324.		1
8	5.2	Earthworm Dissection		Brandwein, pp. 344-46. Essential Laboratory Number 5, "Earthworm Dissection," pp. LS-5-10.	2
9	6.9	Balanced Aquarium/Terrarium	Webster, 341-44. Coble, 39-42.	Brandwein, p. 12.	2
10	6.10.4	Effects of Pollutants on Algae	Webster, 464.		2

LS,A - 5

ESSENTIAL LABORATORY ACTIVITIES MARINE BIOLOGY I

State Accreditor Number . . 1367
Course Code Number. 2320

Introduction

The following laboratory activities are the minimum required for Marine Biology I. Other experiences and activities will enhance the program. The teacher should supplement with activities from the text, Sourcebook, or his/her own experience. Because work at the Marine Science Education Center (MSEC) is required as part of the Essential Laboratories, it is suggested that the teacher make arrangements immediately to obtain dates for visits to the MSEC.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the EL (Essential Laboratory) number. In addition, the teacher will keep on file the student activity sheets for each EL performed. Dates of MSEC field work are to be documented.

Safety is a requirement in the laboratory, and instruction in proper laboratory safety procedures and methods should be presented. Teachers may refer to the front of this manual for additional safety information. Students should sign a laboratory safety contract.

County Adopted Materials

Reseck, John Jr., Marine Biology (Reston, Virginia: Reston Publishing Company, Inc., 1979).

The Sourcebook of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, Inc., 1980).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered in sufficient time to ensure their arrival in time to perform the activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Salt water pH test kit	Science Kit 82-83	69626-03	271
Aquarium hydrometer	Science Kit 82-83	69626-02	270
Water sampling chamber	Science Kit 82-83	65914	371

In addition, a 55 gallon salt water tank and the equipment to maintain it should be obtained.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: The Source Book of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, Inc., 1980).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.1.3	Measurement	25-42		1
2	2.4.3	Collection Equipment		MSEC Field Experience	1
3	2.8	Equipment Operation		MSEC Field Experience	1
4	2.5.2	Marine Aquarium	157		1 - 4
5	2.7.2	Classification Key	49-53	Robert D. Burns and Karl A. Stiles, <u>Laboratory Explorations in General Zoology</u> (New York: MacMillan Publishing Co., Inc., 1977), pp. 3/6-86.	1
6	2.7.4	Classifying Specimens	49-53	Patricia Kirkland, <u>Identification Manual for Common Estuarine Invertebrates of the Little Jetties St. John's River</u> (MSEC, 1981).	1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	3.6	Algae Identification	49-53	E. Yale Dawson, <u>How To Know The Seaweeds</u> (Dubuque, Iowa: William C. Brown Company, 1956). Bayard H. McConnaughey, <u>Introduction to Marine Biology</u> (St. Louis: C. V. Mosby Co., 1978). Alan Major, <u>The Book of Seaweeds</u> (London: Gordon and Cremones, 1977).	1
8	5.4	Plankton Identification	63-67	Patricia Kirkland, <u>Plankton ID Manual</u> , (MSEC, 1973).	2
9	7.3	Coelenterate/ Ctenophore Specimens		Irvin and Vilia Sherman, <u>The Invertebrates: Function and Form - A Laboratory Guide</u> (New York: MacMillan Publishing Co., Inc., 1970), pp. 61, 66, 70, 71, 85-86.	2

MBI - 3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
10	8.5.6	Mollusk Dissection	55-57	Burns and Stiles, pp. 209-16. Stephen G. Gilbert, <u>Atlas of General Zoology</u> (Seattle: University of Washington Press, 1965).	3
11	9.2.7	Arthropod Dissection		Burns and Stiles, pp. 175-88.	3
12	10.3	Echinoderm Identification		Burns and Stiles, pp. 217-25.	3
13	10.8	Sea Star Dissection		Burns and Stiles, 217-25.	4
14	11.6	Chordate Classification		Burns and Stiles, pp. 217-25.	4
15	11.7	Bony Fish and Dogfish Shark Dissection	95-102	Laurence M. Ashley, <u>Lab Anatomy of the Shark</u> (Dubuque, Iowa: Wm. C. Brown Company, 1976).	4

MBI - 4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
15	11.7	(continued) Bony Fish and Dogfish Shark Dissection		Burns and Stiles, pp. 233-39. Robert B. Chiasson, <u>Lab Anatomy of the Perch</u> (Dubuque, Iowa: Wm. C. Brown Company, 1980). Stephen G. Gilbert, <u>Pictorial Anatomy of the Dogfish</u> (Seattle: University of Washington Press, 1973). Saul Wischnitzer, <u>Atlas and Dissection Guide for Comparative Anatomy</u> (San Francisco: W. H. Freeman and Co., 1972), pp. 21-72.	

MBI - 5

ESSENTIAL LABORATORY ACTIVITIES

MARINE BIOLOGY II

State Accreditor Number . . 1367
Course Code Number. 2241

Introduction

The following laboratory activities are the minimum required for Marine Biology II. Other experiences and activities may be supplemented from the text or the teacher's own experience. Teachers should make arrangements to visit the Marine Science Education Center to perform the related essential laboratory activities.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each Essential Laboratory activity is to be recorded in the grade book by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed. The dates of the MSEC field activities are to be documented.

Safety is a requirement in the laboratory, and instruction in proper laboratory safety procedures and methods should be presented. Refer to the front of this book for additional safety information. Each student should also sign a lab safety contract.

County Adopted Materials

The Sourcebook of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, Inc., 1980).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered to ensure their arrival in time to perform the laboratory activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Aquarium (15 gallon)	Science Kit 82-83	60182-15	263
Dip net 3"	Science Kit 82-83	60225-01	270
Dip net 5"	Science Kit 82-83	60225-02	270
Plankton net	Science Kit 82-83	65910	371
Seine net	science Kit 82-83	68562	371

In addition, all equipment necessary to maintain a 15 gallon glass aquarium will be required.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: The Sourcebook of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, Inc., 1980).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.2.2	Data Gathering	11-14, 79-81	John Beakley, <u>Source Book of Marine Sciences</u> (Tallahassee, Florida: Department of Education, 1970), p. 105.	1
2	2.1.1	pH Measurement	39-40	Beakley, p. 35.	1
3	3.2	Closed-System Ecosystem	157	Beakley, p. 1.	1 - 4
4	3.6	Sediment Identification and Classification	19-24	Beakley, p. 23.	2
5	4.5	Zooplankton	63-7	<u>Plankton of the St. Johns River</u> (Marine Science Education Center, Duval County Public Schools, 1974), pp. 1-60.	2
6	4.7	Index Components		Beakley, p. 61.	2 - 3

MBII - 2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	4.8	Counting Methods	63-67	Beakley, p. 61.	2 - 3
8	5.1.2	Scyphozoa/ Ctenophora Representatives	63-71	<u>Plankton of the St. Johns River</u> , pp. 1-60.	3 - 4
9	7.0	Marine Vertebrate Dissection	95-104	L. M. Ashley, <u>Laboratory Anatomy of the Shark</u> (Birmingham, Alabama: (Sargent-Welch, 1976), pp. 1-56.	3 - 4

ESSENTIAL LABORATORY ACTIVITIES MARINE SCIENCE

State Accreditor Number . . 1369
Course Code Number. 2240

Introduction

The following laboratory activities are the minimum required for Marine Science. Other experiences and activities will enhance the program. The teacher should supplement with activities from his/her own experience. Arrangements should be made to take the students to the Marine Science Education Center for field experience.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed. The dates of MSEC field activities are to be documented.

Safety is a requirement in the laboratory, and instruction in proper laboratory safety procedures and methods should be presented. Refer to the front of this book for additional safety information. Students should sign a laboratory safety contract.

County Adopted Materials

The Source Book of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, 1980).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered in sufficient time to ensure their arrival in time to perform the laboratory activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
pH Measurement Set	Science Kit 82-83	66611	155
Universal Hydrometer	Science Kit 82-83	62110	24

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: The Source Book of Marine Sciences (Stuart, Florida: Florida Oceanographic Society, 1980).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1		Compass		<u>Marine Science Resource Packet.</u> *	1
2	2.1.3	Organism Identification	49-53	MSEC Field Experience.	1 - 4
3	9.2.3	Specimen Collection and Classification	49-53	MSEC Field Experience.	1 - 4
4	4.2.9	pH Measurement	39-40	J. Beakley, <u>Source Book of Marine Sciences</u> (Tallahassee, Florida: Department of Education, 1970), p. 35.	2
5	4.3.5	Hydrometer	33-37	<u>Coastal Awareness: A Resource For Teachers In Senior High Science</u> (Washington, D. C., National Oceanographic and Atmospheric Administration, 1978), pp. 39-40.	2

* Available from Science Office

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
6		Sand Grain Analysis	19-24		2 - 3
7		Tides	11-14		2
8	9.3.3	Marine Animals	49-53	<u>Marine Science Resource Packet.</u> *	3
9	9.4.3	Phytoplankton and Protozoan Specimens	43-7	MSEC Field Experience. <u>Plankton of the St. Johns River</u> (Marine Science Education Center, 1977).	1 - 4

* Available from Science Office

.ESSENTIAL LABORATORY ACTIVITIES
PHYSICAL SCIENCE 8

State Accreditor Number . . 1348
Course Code Number. 2520

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Physical Science 8. Suggested resources for teaching the Essential Laboratory (EL) Activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested. Keep in mind that each EL must be experienced, and documentation is to be kept by EL number in the teacher's grade book. In addition, the teacher is to keep on file a copy of each student's activity sheet for the EL's performed.

Safety is a requirement in the laboratory. Laboratory safety procedures and methods are located in the front of this manual and should be presented to all students. Students should also sign a laboratory safety contract.

County Adopted Materials

Barman, Charles, et al, Physical Science (Morristown, New Jersey: Silver Burdett, 1979).

Schachter, Martin, et al, Laboratory Program for Concepts and Challenges in Physical Science (Fairfield, New Jersey: Cebco Standard Publishing, 1978).

Equipment and Supplies

It is suggested that a maximum of four (4) students per group work together. Equipment and supplies should be ordered accordingly, in sufficient time to ensure arrival for class use. The catalog to be used is Science Kit, 1982-83.

<u>ITEM</u>	<u>NUMBER</u>	<u>PAGE</u>
Thermometers - dual scale	63345-01	58
Balances - Harvard Trip (double beam)	65953	459
Weight Sets - metric	60445-05	462
Spring Scales - Dual Calibration (1Kg/10N)	69982-10	462
Alcohol Burners - Aluminum	60840-04	477
Replacement Wicks (Pkg/12)	60840-12	477
Tuning Forks (set of 8)	63525	36
Rubber Hammers	63555	36
Optical Bench Sets (meter stick)	66514	38
Plane Mirrors (unmounted)	66522	38
Concave Mirrors (unmounted)	62596-37	38
Convex Mirrors (unmounted)	62597-37	38
Concave Lenses (double)	62235-05	38
Convex Lenses (double)	62245-05	38
Lamp Receptacles (miniature)	62815-01G	76
Incandescent Lamps (miniature base)	62210-01F	76
Copper Wire (PVC Covered-black) #22	63625-02	536
Copper Wire (PVC Covered-red) #22	63625-04	536
Ammeters - triple range	62453-01	91
Voltmeters - triple range	62450-01	91

NOTES TO TEACHERS OF PHYSICAL SCIENCE 8

Essential Laboratory Activities for performance objective 5.0 (Sound and Mirrors) have been written and included in this guide so that you may make copies for student use. EL #12, "Vibrations: Sound Energy", is designed for students to conclude that (1) vibrations make sounds; (2) sounds travel through solid, liquid, and gaseous media; (3) sound does not travel through a vacuum; and (4) a tuning fork should be struck only with a rubber hammer or on a hard rubber surface. EL #13 is designed for students to investigate plane, concave, and convex mirrors, the images they produce, and the curvature of their surfaces. You may also wish to suggest personal and environmental uses of these mirrors. Reminder: Be sure to preview and prepare for each lab well in advance to provide for smoother laboratory procedures.

The companion copy of the county adopted textbook for this course is a Spirit Master Activity Book containing duplicating pages for all of the activities in the textbook. It is suggested that each teacher secures one copy of this book to provide for uniform student activity sheets which are to be kept as documentation.

The Laboratory Program for Concepts and Challenges in Physical Science is also a duplicating book, and it is county adopted. Since this book is the primary source for six (6) of the Essential Laboratory Activities, each teacher is to be provided one copy.

In addition to the Essential Laboratory Activities, the following list of activities are found in the Physical Science: Spirit Master Activity Book. You are advised to include as many of these activities as possible in your science program:

Objective Number	Title of Activity	Activity Number	Page	Grading Period	Supplementary
1.10.2	Fossil Fuel Use	44	63	1	
1.10.5	Fossil Fuel and Food	45	64	1	
2.2	Using Coordinates	5	6	1	
3.2.1	One Property Identification	2	2	2	
3.3.3	Properties of Elements			2	See "Notes to Teacher," <u>Junior High School Science</u> (Duval County Public Schools, 1980), p. PS-2.

<u>Objective Number</u>	<u>Title of Activity</u>	<u>Activity Number</u>	<u>Page</u>	<u>Grading Period</u>	<u>Supplementary</u>
3.14.6	Neutralizing an Acid	23	37	2	See "Notes to Teacher" p. PS 2.
3.14.8	Physical Properties of Salts			2	
4.1.5	Friction in a Force System	28	43	3	
4.3.3	Using a Ramp	30	45	3	
4.3.5	A Pulley System	32	47	3	
4.4.3	A Pendulum System	34	50	3	
4.4.4	Another Pendulum System	35	52	3	
7.4	Heat Absorption	40	58	4	
7.5	Heat Transfer in Liquids	42	61	4	
7.5	Heat Transfer in Solids	43	62	4	
8.1.4	Half-life	25	40	4	

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Charles Barman, et al, Physical Science (Morristown, New Jersey: Silver Burdett, 1979).

Martin Schachter, et al, Laboratory Program for Concepts and Challenges in Physical Science (Fairfield, New Jersey: Cebco Standard Publishing, 1978).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	2.3.3	Thermometers	Text, 393-95. Lab, 13-14.		1
2	2.4.3	Length Measurement	Text, 378-82.		1
3	2.4.3	Mass Measurement	Text, 383-86. Lab, 15-16.		1
4	2.4.3	Volume Measurement	Text, 387-92.		1
5	3.2.6	Density Determination	Lab, 29-31.		2
6	3.4	Mixtures	Text, 84-85. Lab, 68-69.	Charles Barman, et al, <u>Physical Science: Spirit Master Activity Book</u> (Morristown, New Jersey: Silver Burdett, 1979). Activity #12, pp. 18-19.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	3.13.2	Solutions	Text, 92-93. Lab, 70-75.	Barman, Activity #14, pp. 21-22.	
8	3.14.5	Common Acids and Bases	Text, 166-67. Lab, 80-81.	Barman, Activity #22, pp. 35-36.	2
9	4.1.6	Force - Mass Relationship	Text, 203.	Barman, Activity #29, p. 44.	3
10	4.2	Work	Lab, 20-22		3
11	4.3.4	Levers	Text, 209. Lab, 23-25.	Barman, Activity #31, p. 46.	3
12	5.2	Vibrations: Sound	Lab, 36-37.	"Physical Science 8" Essential Laboratory Activities Guide: Secondary Science (Duval County Public Schools, 1981), p. PS8-8.	3
13	5.13.1	Mirrors: Plane, Concave, and Convex	Lab, 40-41.	Physical Science 8, p. PS8-10	3

PS8-6

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
14	5.14.1	Lenses: Concave and Convex	Lab, 42-43.		3
15	6.2.7	Circuit Construction	Text, 240. Lab, 3-4.	Barman, Activity #36, p. 53.	4
16	6.2.13	Electric Circuit Measurements	Text, 250-51.	Barman, Activity #39, pp. 56-57.	4
17	6.3.2	Electromagnet	Text, 245. Lab, 9-10.	Barman, Activity #37, p. 54.	4
18	6.3.4	Magnetic Fields	Lab, 7-8.		4
19	6.4.1	Electricity- Magnetism Relationship	Text, 247.	Barman, Activity #38, p. 55.	4

PS8-7

ESSENTIAL LABORATORY NUMBER 12

Vibrations: Sound Energy

Sound is a form of energy produced when matter vibrates. Sound travels in longitudinal waves through material called a medium. In this activity you will investigate the different kinds of media through which sound travels. You will also discover what happens when there is no medium through which sound can travel.

Materials

tuning fork*
test tube
ruler-metric
rubber band
large can or drum
sand
water
beaker

Procedure

1. Strike a tuning fork gently. Listen to the sound. Sound waves are traveling through the air, which is a mixture of gases, from the tuning fork to your ear.
2. Fill a beaker with water. Touch the quiet tuning fork to the surface of the water. Lift the fork from the surface. Now strike the tuning fork and touch it to the surface of the water.
3. Hold a plastic ruler at the edge of a table, with one end sticking out over the edge. Snap the free end with your other hand.
4. Hold an "empty" test tube (filled with air) at the edge of your lower lip. Blow hard across the open end of the test tube.
5. Strike the tuning fork again. Hold the bottom of the tuning fork against your desk top. Place your ear firmly on the desk and listen.
6. Have a friend stretch a rubber band between his two hands for you while you pluck the rubber band.
7. Place a large can or drum on the table. Strike it hard and quickly sprinkle some sand on the top or head of the drum.
8. To find out if sound can travel through a vacuum, a demonstration will be done by your teacher.

*NOTE: Do not strike the tuning fork before your teacher gives instructions on its proper use.

ESSENTIAL LABORATORY NUMBER 12

Vibrations: Sound Energy

Student Laboratory Report

NAME _____

DATE _____

PERIOD _____

1. Can sound travel through gases? _____

2. What happened when you touched the quiet tuning fork to the water? _____
_____What happened after you struck the tuning fork and touched the water? _____

Can sound travel through a liquid? _____

3. What happened when you snapped the ruler at the edge of the table? _____

Can sound travel through a solid? _____

4. What happened when you blew across the open end of the test tube? _____

What medium did sound travel through? _____

5. What did you hear when you placed the vibrating tuning fork against your desk top? _____

What medium was sound traveling through? _____

6. What did you see and hear as you plucked the stretched rubber band? _____

What medium was sound traveling through? _____

7. What did you see and hear as you sprinkled sand on the vibrating can or drum head? _____

Did the sand stop bouncing? _____

Why? _____

8. Can sound travel through a vacuum? _____

Why? _____

ESSENTIAL LABORATORY NUMBER 13

Mirrors: Plane, Concave, and Convex

Mirrors are smooth surfaces which show regular reflections of light. They also do other things. They form images by reflecting pictures of the objects in front of them, but they do not tell the whole truth. In this activity you will investigate three kinds of mirrors and determine the kinds of images they form.

Materials

large plane mirror
rounded, shiny soup spoon
shaving mirror
side-view auto mirror
small candle
book or magazine
meter stick

Procedure

1. Stand about 1 meter in front of a large flat mirror. Hold up your left hand while looking in the mirror.
2. Hold an open book up to the mirror and look at the print in the mirror.
3. Have a classmate measure with a meterstick the height of your image in the mirror. Now walk backwards away from the mirror. Have your classmate measure the height of your image again.
4. Look at your face in the shaving mirror. Move the mirror closer to your face, then move it back again.
5. Look at your face in the side-view mirror. Move the mirror closer to your face, then move it back again.
6. Use the rounded soup spoon to look at your reflection on the front and back of the spoon. Follow the same procedures you used with the shaving mirror and side-view mirror. Compare the spoon's curvature with the two mirrors.
7. Light a small candle and look at its image on the front and back of the spoon. Move the spoon close to the candle, then away from it again.

ESSENTIAL LABORATORY NUMBER 13
Mirrors: Plane, Concave, and Convex
Student Laboratory Report

NAME _____
DATE _____
PERIOD _____

1. Which hand is held up by the image in the mirror? _____
2. How does the print on the page appear in the mirror? _____
3. How does the height of the image in the mirror compare with your actual height? _____
4. What happens to your image in the mirror as you move backwards? _____

5. Describe the size and shape of your face as it appears in the shaving mirror. _____
Describe the image as you move the mirror closer _____
_____ ; back again _____
6. Does your face appear different in the side-view mirror than in the shaving mirror? _____ ; How? _____
What happens as you move the mirror closer? _____
back again? _____
7. A. Which mirror shows an image of your face as it appears in the front of the spoon? _____
B. Which mirror shows an image of your face as it appears on the back of the spoon? _____
C. The inside of the spoon is curved in like the _____ mirror.
D. The back of the spoon is curved out like the _____ mirror.
E. Mirrors that are curved "in" are called _____ mirrors, and they make images appear (larger, smaller) and (upright, upside down).
F. Mirrors that are curved "out" are called _____ mirrors, and they make images appear (larger, smaller) and (upright, upside down).
8. Describe the lighted candle as it appeared on the spoon's
A. Front _____
B. Back _____

ESSENTIAL LABORATORY ACTIVITIES
PHYSICAL SCIENCE II

State Accreditor Number . . 1355
Course Code Number. 2530

Introduction

The following laboratory activities are required for Physical Science II. Other experiences and activities will enhance the program. The teacher should supplement with activities from the text or his/her own experience.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory setting. Proper safety procedures should be introduced, stressed, and maintained. Extra caution should be applied when suspending weights, applying tension to springs, and using electricity, and general laboratory rules should be followed. Weights can fall on hands and feet. Springs under tension can be released, flying outward to strike objects or people placed in their path. Crossed electrical wires can result in burns, shock, or fire. All students must sign a laboratory safety contract.

County Adopted Materials

Tracy, G. R., et al, Modern Physical Science (New York: Holt, Rinehart, and Winston, 1979).

Friedl, A. E., et al, Exercises and Investigations for Modern Physical Science, (New York: Holt, Rinehart, and Winston, 1979).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered in sufficient time to ensure their arrival in time to perform the laboratory activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Harvard trip balance - single beam	Science Kit 82-83	66323	459
Hook weight set (1 per set of 4)	Science Kit 82-83	60465	462

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: G. R. Tracy, H. E. Tropp, and A. E. Friedl, Modern Physical Science (New York: Holt, Rinehart, and Winston, 1979).

A. E. Friedl & F. V. Kitko, Exercises and Investigations for Modern Physical Science, (New York: Holt, Rinehart, and Winston, 1979).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.4	Laboratory Measurement	Friedl, 9-11.	C. R. Barman, et al, <u>Physical Science</u> (Morristown, N.J.: Silver Burdett, 1979), pp. 378-95.	1
2	1.4	Density of a Solid	Friedl, 17-18.		1
3	1.5.4	Data Collection/ Analysis		Barman, p. 219.	1
4	1.6.2	Graph Construction		Barman, pp. 28-32; pp. 34-35.	1
5	2.2.2	Properties and Changes of Matter	Friedl, 15-16.		2
6	2.2.2	Mixtures and Compounds	Friedl, 15-16.		2

PSII-2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
7	2.7.4	Law of Conservation of Matter	Tracy, 26.	J. J. Weisler, et al, <u>Physical Sciences Workbook</u> (New York: AMSCO School Publications, Inc., 1971), pp. 85-86.	2
8	2.8.4	Properties of Acids	Friedl, 31-32.	Weisler, pp. 147-48.	2
9	2.8.4	Behavior of Bases	Friedl, 33-34.	Weisler, pp. 147-48.	2
10	2.10.3	Solutions and Crystals	Friedl, 23	Weisler, pp. 109-18.	3
11	4.2.6	Half Life		Barman, p. 183	3
12	5.2.4	Applying Newton's First Law	Friedl, 109-10.		3
13	6.2.5	Lever Systems		Barman, p. 209	3
14	6.3.5	Pulley System		Barman, p. 211	3
15	6.4.3	Inclined Plane as a Machine	Friedl, 113-14.		4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
16	7.1.2	Static Charges	Friedl, 149-50.		4
17	7.5	Series and Parallel Circuits		Barman, p. 240.	4

PS11-4

ESSENTIAL LABORATORY ACTIVITIES
PHYSICS I
PHYSICS I, ADVANCED

State Accreditor Number . . 1318
Course Code Number. 2501 (PI), 2502 (PI,A)

Introduction

Students taking both standard and advanced Physics I are expected to perform the same essential laboratory activities. Advanced students, however, are expected to demonstrate a more complete analysis of the results obtained than the standard students. It is expected that students entering at this course level have had prior laboratory experiences in measurement, data tabulation, graphing, and scientific method.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory setting. Proper safety procedures should be introduced, stressed, and maintained. Extra caution should be applied when suspending weights, applying tension to springs, and using electricity, and general laboratory rules should be followed. Weights can fall on hands and feet. Springs under tension can be released, flying outward to strike objects or people placed in their path. Crossed electrical wires can result in burns, shock, or fire. All students must sign a laboratory safety contract.

County Adopted Materials

Murphy, James T., Laboratory Physics (Columbus, Ohio: Charles E. Merrill Publishing Co., 1982).

Equipment and Supplies

There is a helpful annotated teacher's edition of the county adopted laboratory manual. A listing of equipment is found at the end of this manual.

It is suggested that teachers order carbon disks and paper tape for tape timers so they will have sufficient quantity at the beginning of school; otherwise, the first quarter laboratory activities will not be possible. The range of the voltmeters, ammeters, resistors, and power source should match $V=IR$. Resistors with higher wattage ratings are more expensive but dissipate heat better and are worth the expense.

Quantities listed are for a group of two to four students.

The teachers should order the following supplies based on the number of activity groups per class. Quantities listed are for one small activity group.

<u>QUANTITY</u>	<u>ITEM</u>
1/4 pkg.	carbon disks
1/2 pkg.	paper tape timer tape
20	washers (2 to 3 cm)
1/2 box	iron filings
1	iron nails (10 penny size)
1	bell wire (10
1	dynamics cart without spring mechanism
1	dynamics cart with spring mechanism
1	tape timer
1	power source for tape timer
3	C clamps (4 in.)
6	500 g. mass
2	200 g. mass
2	50 g. mass
1	100 g. mass
2	20 g. mass
1	15 g. mass
2	10 g. mass
1	meterstick
1	balance (pan type, measures up to 4 kg.)
1	pulley with clamp (for mounting on edge of table)
	or pulley on a rod plus right angle clamp and
	ring stand
1	force board and spring scales or 3 spring scales
	(range .1 to 2.5 N) and vertical rods with
	cross supports, clamps
1	Hooke's law apparatus or 1 spring (1.3 cm X
	20 cm) with supporting hooks on each end and
	ring stand with right angle clamp
1	ringstand and rod
1	right angle clamp
1	volt meter (DC)
1	ammeter (DC)
1 set	resistors (4 each of 4 different sizes, 5-10
	watt)
1	power source (DC for circuit building)
10	connecting wires (to fit DC power source,
	ammeter, voltmeter and resistors) or small
1	jaw medium size alligator clips, bell wire,
	wire strippers

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: James T. Murphy, Laboratory Physics (Columbus, Ohio: Charles E. Merrill Publishing, 1982).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.0	Measuring Short Time Intervals Using Tape Timers	17-19		1
2	PI: 2.3.5 2.4.4 PI, A: 2.3.2 2.5.1 2.7.4 2.6	Graphical Analysis of Motion (Distance-Time Velocity-Time Graphs)	23-30		1
3	PI: 2.4 PI, A: 2.6.2	Uniform Acceleration (Distance, Velocity-Time Graphs of Free Fall)	31-36		1
4	PI: 2.2 PI, A: 2.2.5	Addition of Vectors	37-39		2

PI-3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
5	PI: 3.3.5 PI, A: 3.5.5	Force and Acceleration with Mass Constant	43-46		2
6	PI: 3.3.5	Force and Acceleration with Force Constant	47-50		2
7	PI: 3.4.7 PI, A: 5.4.1	Conservation of Momentum in a Straight Line: Internal Force	51-53		2
8	PI: 4.5 PI, A: 4.0	Conservation of Energy	83-86		2 or 3
9	PI: 5.2.2 PI, A: 7.2	Simple Harmonic Motion: Hooke's Law	13-16		3

PI-4

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
10	PI: 5.2.10 PI, A: 7.8.11	The Period of a Simple Pendulum	71-74		3
11	PI: 7.3.8 PI, A: 9.7.8	Using Volt and Ammeter (Ohm's Law)	171-73		3 or 4
12	PI: 7.3.5 PI, A: 9.7.7	Building and Measuring Values of A Series Circuit	175-78		4
13	PI: 7.3.6 PI, A: 9.7.7	Building and Measuring Values of a Parallel Circuit	179-82		4

PI-5

ESSENTIAL LABORATORY ACTIVITIES
PHYSICS II B, ADVANCED

State Accreditor Number . . 1329
Course Code Number. 2511

Introduction

This course follows the outline provided by the College Entrance Examination Board and prepares the student for the Advanced Placement Examination in physics identified as Physics B. The course, Physics IIB, is physics without calculus. Physics IIC, which utilizes calculus and prepares students for the Advanced Placement C examination, will be field tested in the Duval County Schools in the near future.

Activities used in this course are intended to help students understand physics concepts more fully. The listed activities are minimum, and teachers are encouraged to supplement them with more activities as appropriate.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory setting. Proper safety procedures should be introduced, stressed, and maintained. Special caution should be utilized with high voltage power supplies. All students must sign a laboratory safety contract.

County Adopted Materials

Haber-Schaim, Uri, et al, Laboratory Guide PSSC Physics (Lexington, Massachusetts: D. C. Heath and Company, 1981).

Equipment and Supplies

Quantities listed are for one small activity group. The teacher should order quantities based on the number of activity groups per class. Order number refers to the equipment catalog from Science Kit, Inc., Tonawanda, New York, 1983.

QUANTITY	ITEM NAME	STOCK NUMBER	CATALOG PAGE
1	inertial balance	66458	126
8	C clamps (4 in. jaw)	61073-04	483
2	ringstand or support base with tall rod (36 in. if possible)	63080-04	507
1	right angle clamp	61120	482
1	collision in two dimensions apparatus	66448	125
1	mass of electron apparatus	69717	125
1	universal power supply	69716	124
1	semicircular plastic transparent box	66462	127
1	spectrometer with grating	66467	127
1	hydrogen spectrum tube	62999-11	48
1	mercury spectrum tube	62999-14	48
1	spectrum tube power supply	62999-26	48
8	connecting wires (banana plug or small nosed alligator clip type)	63622D	537
1	photoelectric effect module	69718	125
1	current amplifier with meter	69719	124
1	point light source	69715	128
1	voltmeter	62438-04	92

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Uri Haber-Schaim, et al, Laboratory Guide PSSC Physics (Lexington, Massachusetts: D. C. Heath and Company, 1981).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.1.6	Experiment Analysis	100-02		1
2	2.1.9	Inertial Balance	7-9		1
3	3.2.10	Momentum (Vector Addition)	19-22		1
4	8.3.8	Electron Beam Influenced By Electric Fields	37-40		2
5	9.3.6	Spectroscope	93-95		3
6	9.4.5	Refraction	67-69		3
7	10.1.21	Photoelectric Effect	74-76		4

PIIe-3

ESSENTIAL LABORATORY ACTIVITIES
SCIENCE SURVEY - BIOLOGICAL

State Accreditor Number . . 1354
Course Code Number. 2262

Introduction

The Laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for Science Survey - Biological. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the EL number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Oxenhorn, Joseph M. et al, Pathways in Biology Laboratory Manual (New York, New York: Globe Book Company, Inc., 1975).

Equipment and Supplies

A listing of equipment and supplies needed for the designated lab activities is included in the teaching guide for the laboratory manual and at the beginning of each laboratory. Check the listing in sufficient time to order and receive any materials you may need.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: Joseph M. Oxenhorn, et al, Pathways in Biology Laboratory Manual (New York, New York: Globe Book Company, Inc., 1975).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.4	Microscope Use	13-22	A. Benson, et al, <u>Laboratory Investigations in Biology</u> (Morristown, N.J.: Silver Burdett, 1974), pp. 3-6. E. Fabiano, et al, <u>Life Activities and Explorations</u> (Boston, Mass.: Houghton-Mifflin, 1975), pp. 109-17. J. Otto, et al, <u>Biology Investigations</u> (New York: Holt, Rinehart and Winston, Inc., 1973), pp. 13-17.	1
2	2.3.4	Enzyme Activity	119-20	Benson, pp. 18-19. Fabiano, pp. 158-59.	1
3	2.4.9	Chemical Nutrients in Foods	81-84	Benson, pp. 14-16. Fabiano, pp. 141-45.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
4	3.0	Genetics	189-92	Fabiano, pp. 277-79. Otto, pp. 77-80.	2
5	4.1.2	Bacterial Growth	193-96	Benson, pp. 104-05. Fabiano, pp. 307-10.	3
6	5.2.3	Plant Behavior	165-70	Fabiano, pp. 70-74.	3
7	6.3.7	Flower Dissection	181-84	Benson, p. 80. Otto, pp. 213-16. Fabiano, pp. 250-53.	3
8	7.1	Food Chain Structure	121-26 145-48	Fabiano, pp. 79-80.	4

SS-B-3

ESSENTIAL LABORATORY ACTIVITIES

SCIENCE SURVEY - EARTH/SPACE

State Accreditor Number . . 1343
Course Code Number 2264

Introduction

The following laboratory activities are the minimum required for Science Survey - Earth/Space. Other experiences and activities will enhance the program. The teacher should supplement with activities from the text, Resource Book, or his/her own experience. The Essential Laboratory Activities are keyed to both the 1978 and 1982 editions of Holt Earth Science.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the EL (Essential Laboratory) number. In addition, the teacher will keep on file the student activity sheets for each Essential Laboratory performed.

Safety is a requirement in the laboratory, and instruction in proper laboratory safety procedures and methods should be presented. Refer to the front of this book for additional safety information. Students should sign a laboratory safety contract.

Schools needing to complete existing inventories of 1978 editions may order them directly from the publisher. Schools ordering books for the first time will order the 1982 edition.

County Adopted Materials

Ramsey, W. L., et al, Holt Earth Science (New York: Holt, Rinehart, and Winston, 1978).

Ramsey, W. L., et al, Holt Earth Science (New York: Holt, Rinehart, and Winston, 1982).

Ramsey, W. L., et al, Holt Earth Science Resource Book (New York: Holt, Rinehart, and Winston, 1978).

Ramsey, W. L., et al, Holt Earth Science Resource Book (New York: Holt, Rinehart, and Winston, 1982).

Equipment and Supplies

It is suggested that the following equipment and supplies be ordered in sufficient time to insure their arrival in time to perform the laboratory activities.

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Harvard Trip Balance	Science Kit 82-83	66323	459
Student Mineral Identification Kit	Science Kit 82-83	63972	412
Hook Weight Set	Science Kit 82-83	60465	462

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: W. L. Ramsey, et al, Holt Earth Science (New York: Holt, Rinehart, and Winston, Inc., 1978).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1		Balance	7-8		1
2	1.3	Laboratory Measurements/Density	10-12		1
3	2.3	Mineral Properties	146-47		1
4		Mineral Identification		W. L. Ramsey, et al, <u>Holt Earth Science Resource Book</u> (New York: Holt, Rinehart, and Winston, Inc., 1982), pp. 87-88. W. L. Ramsey, et al, <u>Modern Earth Science Activities and Investigations</u> (New York: Holt, Rinehart, and Winston, Inc., 1979), pp. 85-87.	1
5	2.8	Sedimentary Rock	170-72		1

SS-E/S - 3

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period /
			County Adopted Pages	Supplementary	
6	2.11	Chemical Weathering	177		1
7	2.12	Physical Weathering	182-83		1
8	2.15	Soil Examination	188-89		2
9	3.3.4	Earthquake Locations	25		2
10	3.4.4	Volcano Locations	31-32		2
11	4.4.4	Convection	258		3
12	4.4.5	Heating Rates	259		3
13	4.6	Evaporation	267-68		3
14	4.6.3	Relative Humidity	273		3
15	4.7.3	Dew Point	280-81		3
16	5.5.2	Moon Phases	386-87		4

SS-E/S - 4

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: W. L. Ramsey, et al, Holt Earth Science (New York: Holt, Rinehart, and Winston, Inc., 1982).

W. L. Ramsey, et al, Holt Earth Science Resource Book (New York: Holt, Rinehart, and Winston, Inc., 1982).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.2	Balance	Text, 8-9.		1
2	1.3	Laboratory Measurements/Density	Text, 10-11, 56.		1
3	2.3	Mineral Properties	Text, 152.		1
4	2.2	Mineral Identification	Resource, 87-88.	W. L. Ramsey, et al, <u>Modern Earth Science Activities and Investigations</u> (New York: Holt, Rinehart, and Winston, Inc., 1979) pp. 85-7.	1
5	2.8	Sedimentary Rock	Text, 178-79.		1
6	2.11	Chemical Weathering	Text, 187-88.		1
7	2.12	Physical Weathering	Text, 192-93.		1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
8	2.15	Soil Examination	Text, 198-99.		2
9		Earthquake Locations	Text, 30-31.		2
10		Volcano Locations	Text, 38-39.		2
11	4.4.4	Convection	Text, 274-75.		3
12	4.4.5	Heating Rates		W. L. Ramsey, et al, <u>Holt Earth Science</u> (New York: Holt, Rinehart, and Winston, Inc., 1978) p. 259.	3
13	4.6	Evaporation	Text, 286-87.		3
14	4.6.3	Relative Humidity	Text, 288-89. Resource, 121.		3
15	4.7.3	Dew Point	Text, 298-300.		3
16		Moon Phases	Text, 402- 403.		4

ESSENTIAL LABORATORY ACTIVITIES SCIENCE SURVEY - PHYSICAL

State Accreditor Number . . 1354

Course Code Number. 2263

Introduction

The following laboratory activities are required for Science Survey - Physical. Other experiences and activities will enhance the program. The teacher should supplement with activities from the text or his/her own experience.

It will be necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the grade book by the Essential Laboratory (EL) number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory, and instruction in proper laboratory safety procedures and methods should be presented. Refer to the front of this book for additional safety information.

County Adopted Materials

Bernstein, L. et al, Concepts and Challenges in Physical Science (Fairfield, New Jersey: Cebco Standard Publishing, 1978).

Schachter, M., et al, Laboratory Program for Concepts and Challenges in Physical Science (Fairfield, New Jersey: Cebco Standard Publishing, 1978).

Equipment and Supplies

<u>ITEM</u>	<u>CATALOG</u>	<u>NUMBER</u>	<u>PAGE</u>
Harvard Trip Balance - Single Beam	Science Kit 82-83	66323	459
Hook weight set (1 per group of 4)	Science Kit 82-83	60465	462

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: M. Schachter, et al, Laboratory Program for Concepts and Challenges in Physical Science (Fairfield, New Jersey: Cebco Standard Publishing, 1978).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	2.5.1	Meter Stick		C. R. Barman, et al, <u>Physical Science</u> (Morristown, New Jersey: Silver Burdett Co., 1979), pp. 378-82. A. E. Friedl, et al, <u>Exercises and Investigations for Modern Physical Science</u> (New York: Holt, Rinehart, and Winston, 1979), pp. 9-11.	1
2	2.5.2	Balance		Barman, pp. 383-86. Friedl, pp. 9-11.	1
3	2.5.3	Graduated Cylinder		Barman, pp. 387-92. Friedl, pp. 9-11.	1

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
4	4.4.2	Chemical and Physical Changes	46-47, 54-55	Barman, pp. 52, 96, 110-11, 132. T. E. Eckert, et al, <u>Discovery Problems in Chemistry</u> (Fairfield, N.J.: Cebco Standard Publishing, 1968), p. 15.	1
5	4.7	Preparation of Solutions	70-71	Barman, pp. 88, 92-93, 96.	2
6	4.9.2	Common Substances (Elements, Compounds, Mixtures)	68-69	Barman, pp. 84-85. Freidl, pp. 15-16. J. J. Weisler, et al, <u>Physical Science Workbook</u> (New York: AMSCO School Publications, Inc., 1971), pp. 41-44.	2
7	4.12.5	Common Substances (Acids and Bases)	80-81	Barman, pp. 166-67. Friedl, pp. 31-34.	2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
8	4.13.2	Law of Conservation of Matter		Friedl, pp. 35-36. G. R. Tracy, et al, Modern Physical Science (New York: Holt, Rinehart, and Winston, 1979), p. 26 or p. 27.	3
9	5.11.4	Measurement of Work	70-72	Barman, p. 206.	3
10	6.4.5	Reflection of Light	40-41		3
11	6.4.7	Production of Color	44-45		3
12	7.3	Induction and Conduction	3-4	Friedl, pp. 149-50.	4
13	7.5.6	Construction of Series Circuits	3-4	Barman, p. 240, 250-51.	4
14	7.6.3	Testing Materials (Conductors and Insulators)	1-2		4

SS-P - 4

ESSENTIAL LABORATORY ACTIVITIES ZOOLOGY

State Accreditor Number . . . 1366
Course Code Number 2630

Introduction

The laboratory activities listed in this section have been identified as essential in meeting the minimum requirements for zoology. Suggested resources for teaching the Essential Laboratory (EL) activities are included in this guide. However, other resources or laboratories may be substituted for or added to those suggested. A packet of zoology resource materials is available from the science office, 390-2129.

It is necessary for the teacher to provide documentation that each activity has been performed. Each essential activity is to be recorded in the gradebook by the EL number. In addition, the teacher will keep on file the student activity sheets for each EL performed.

Safety is a requirement in the laboratory. Instruction in proper laboratory procedures and methods are located in the front of this manual and should be presented to all students. Students should sign a laboratory safety contract to be kept on file.

County Adopted Materials

Storer, J. et al, Laboratory Workbook for Zoology (Heightstown, N.J.: McGraw Hill Book Company, 1965).

Equipment and Supplies

Review laboratory activities and supply needs well ahead of time. Place supply orders sufficiently early to ensure receiving materials before they are needed.

ESSENTIAL LABORATORY ACTIVITIES

County Adopted Materials: J. Storer, et al, Laboratory Workbook for Zoology (Heightstown, N.J.: McGraw Hill Book Company, 1965).

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
1	1.6	Scientific Method		Hummer, Paul J., Jr., et al, <u>Probing Levels of Life: A Laboratory Manual</u> (Columbus, Ohio: Charles E. Merrill Publishing Co., 1970), pp. 13-14.	
2	2.6	Animal Cell Locomotion		Hummer, pp. 162-65.	1
3	3.4.6	Metamorphosis	97-99	Zoology Resource Packet, (Duval County Public Schools). Hummer, pp. 86-89.	2
4	4.2.3	Monohybrid Cross	49-51	Hummer, pp. 53-56.	2
5	4.5.1	X-linked Genes	49-51	Hummer, pp. 57-59.	2

Z-2

ESSENTIAL LABORATORY ACTIVITIES

Essential Laboratory Number	Objective Number	Activity	Resources		Suggested Grading Period
			County Adopted Pages	Supplementary	
6	5.7	Dichotomous Keys	57-63	Hummer, pp. 103-04. <u>Zoology Resource Packet.</u>	2
7	7.0	Unicellular Animals	63-68	Hummer, pp. 111-12.	3

Z-3